OHC Team Integration Workshop

Activities Bldg
October 26, 2006
9:00-11:00

Agenda

9:00-9:05	Welcome – Opening Remarks	Susan Whitfield
9:05-9:20	OHC Learning Topic: Evolved Client Solutions/OD Model	Susan Whitfield
9:20-9:45	Agency Learning Topic: NASA Shared Services Center (NSSC)	Cathy Fletcher, MSFC NSSC Liaison
9:45-10:45	OHC Client Learning Topic: Understanding the 'Excellence in Engineering' Initiative	Bob Ryan, Jim Blair, Luke Schutzenhofer
10:45-11:00	Future Team Integration Topics/ Wrap-Up	All

Welcome – Opening Remarks

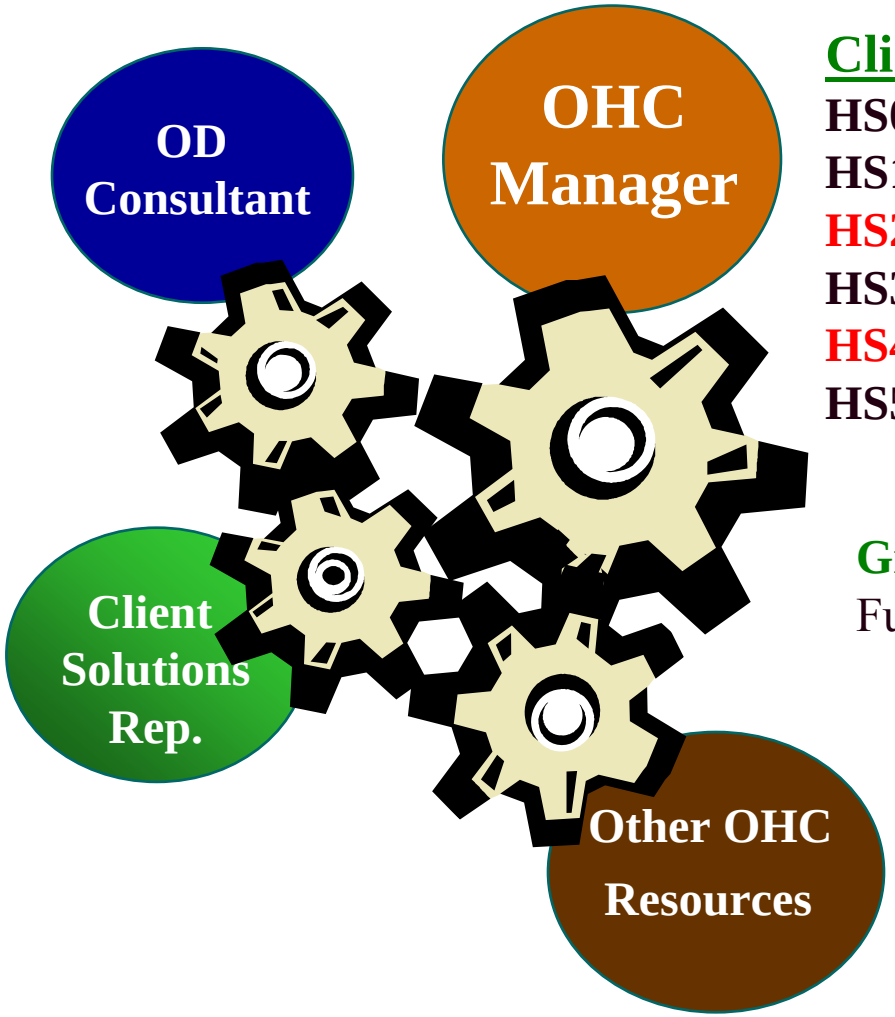
IPT Approach – *An Agency Best Practice*

- Robin Henderson/Associate Center Director briefed the Integrated Product Team/Client Solutions Team model at the Agency Administrative Solutions Conference on October 18.
- Shared this model and approach as a **'best practice'** for Marshall.
- Email excerpt from Robin:
  - "The briefing went well today. I received several comments after the briefing from people who thought this was a great concept. I also fielded several questions. The HQ I&A deputy was very interested and said he might like more information. I invited him to the Center for a briefing and he said he would consider doing this. **Well done on this innovative solution!"**
- **We <u>are</u> making a difference!**

OHC Learning Topic:
Evolved Client Solutions/OD Model

Moving Forward…

- **Adopting a 'teaming' model with identified resources focused internally** (*modified Client Solutions Team role*)



Client Solutions		*OD Consultant	Manager
HS01		Mike C.	Tereasa
HS10		Mike C.	Jim A.
HS20	Drew	Diane	David
HS30		Diane/Brian	Jim E.
HS40	Susan	Elisabeth	Tricia
HS50		Diane/Brian	Danny

**WYE = 3+*

Greg: Cross-cutting resource for the team. Future state focused.

"Other OHC Resources" are key to the model. Includes the entire OD Team, and other OHC offices. The Business Management Team members in particular will be more actively engaged to fully tap into those resources.

Client Solutions Refocused

Primary Impact Emphasis via Teaming Model:

- Internal functional effectiveness and integration (e.g., continual feedback/improvement via IPT forums)
- Education and awareness around OHC products and services for all clients and customers
- Fostering alignment of OHC activities with Center/Agency efforts
- Gathering emerging best practices in human capital management through benchmarking and other interactions

Key Strengths

- **A stronger partnership with OHC Managers.**
- **Better use of talents and resources.**
- **Improved integration/ facilitation via IPT forums.**

OHC Dedicated Resources 'Model' - *Benefits*

- **Maximizes use of resources to obtain desired outcomes through teaming of Client Solutions and OD Professionals**
- **Focused approach to intervene on OHC culture issues, process impediments, effectiveness roadblocks; make recommendations for optimal use of OHC resources; 'big' OHC data-enabled picture to apply appropriate interventions; assess success factors and continuously improve processes – creates 'win-win' situation for OHC as an organization, and for the Center as the recipient of improved products/services**
- **Serves as an valuable integrated information source for OHC Director**
- **Improves integration through a sharper, more engaged functional perspective** (although *functionally* focused, does not feed organizational stove-piping)
  - *Client Solutions* will be an 'embedded' resource; attend staff meetings; foster integration; serve as a resource for high visibility priorities
  - *OD Consultants* will have a functional focus for data collection/observations/feedback, and corresponding improvement/implementation plans

OHC Dedicated Resources Model

Mode of Operation

- Group will meet on a regular and frequent basis to ‘connect’ and integrate.
- While focused internally, the group will not be precluded from pulling from complete HS10/OHC resource pool to diagnose/plan/implement as required and warranted. Requests for such assistance shall be handled as ‘new work’ and prioritized accordingly.
- Assigned point of contact will serve as the ‘go to’ person for direct access by OHC Director.

Agency Learning Topic: NASA Shared Services Center (NSSC)

NASA Shared Services Center

Customer Focused

NASA Shared Services Center:

AN NSSC INTRODUCTION

The "what, why, and how" of Shared Services

NASA Shared Services Center
Customer Focused

WHAT – is Shared Services?

Shared Services is an approach to providing services to multiple organizations to achieve economies of scale without losing customer focus.

WHY – implement Shared Services?

- To reduce costs, improve internal services, and elevate overall performance
- To eliminate duplication of support functions and standardize processes and systems
- To allow the business units to concentrate on improving core activities

HOW – will Shared Services be implemented?

Achieving Economies of Scale through:

- standardization and
- automation

Maintaining customer focus by:

- implementing service level agreements (SLAs),
- implementing usage based chargebacks
- actively managing customer relationships

Is this a new concept?

- Shared Services is a common approach in industry:
  - Currently 70% of the Fortune 500 companies utilize Shared Services
  - Benchmarking data indicates that organizations utilizing a shared services environment are closer to the competitive benchmark level of performance than those organizations not utilizing a shared services approach.
  - Significant cost and efficiency savings have been achieved as well higher levels of accuracy and customer service.

What is the NSSC?

NASA Shared Services Center
Customer Focused





The NSSC is a Shared Service Center consolidating a variety of transactional and administrative activities currently being done at each NASA center and Headquarters:

- Human Resources
- Information Technology
- Financial Management
- Procurement

The NSSC opened for business on March 1, 2006. The Center is staffed by a team of Civil Servants and Service Provider, Computer Sciences Corporation (CSC) and its team. We are located at the John C. Stennis Space Center in Mississippi.




NSSC Vision: Unparalleled Service

NSSC Mission: To provide timely, accurate, high quality, cost effective, and customer focused support for selected NASA business and technical services.

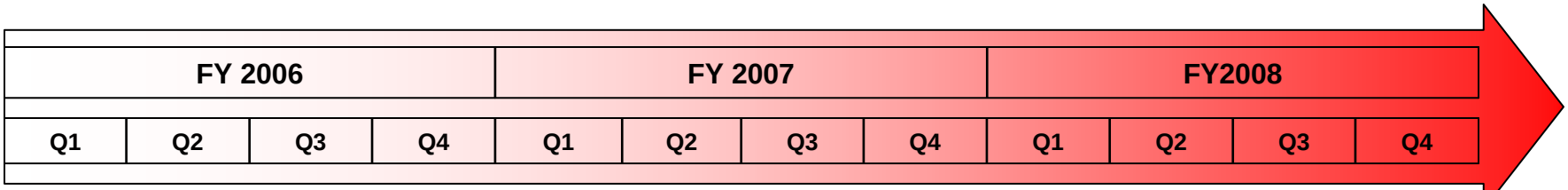
How will the NSSC affect me?

The NSSC is consolidating transactional and administrative functions in Financial Management, Human Resources, Procurement, and Information Technology. Examples include:

- **Change of Station (COS)** (FM) – Presently the Centralized Travel Office (CTO) at Johnson Space Center (JSC) coordinates and pays COS vouchers. After transition, the NSSC will coordinate and pay COS vouchers.
- **Payroll** (FM) – Currently consolidated and located at Marshall Space Flight Center (MSFC) and coordinated through DOI. The NSSC will assume responsibility after transition.
- **Organization of Health Fairs** (HR) – Currently Human Resource Offices (HRO) organize Employee Health Fairs. The NSSC will assume administration, planning, and logistical support for Center Health Fairs.
- **Training Purchases** – Currently performed by Center Training Officers, Procurement Support, Contractor. The NSSC Service Provider will now provide support for this effort including registration, payment to training entity, etc.

Financial Management Transition Schedule by Service

NASA Shared Services Center
Customer Focused



Travel

- Foreign Travel/ PCS
- Domestic Travel

Payroll

- Payroll

Accounts Payable

- AP (Wave I-MSFC, GRC, JSC, SSC)
- AP (Wave II-KSC, LaRC, ARC, DFRC; Wave III-GSFC)
- SF224/GL/Reporting

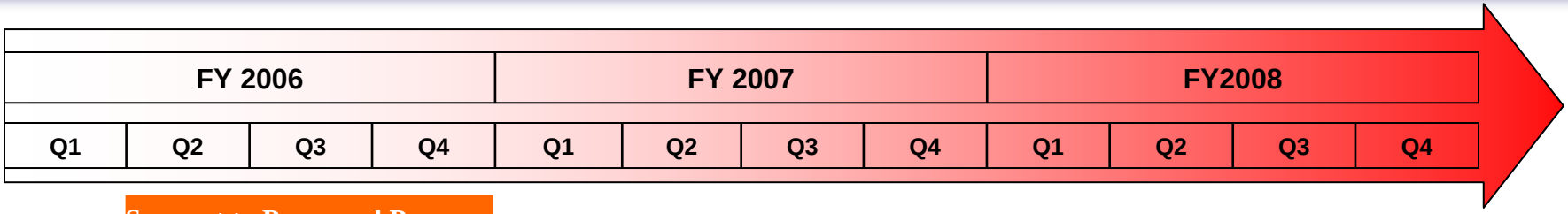
Accounts Receivable

- AR (Wave I-MSFC, GRC, JSC, SSC)
- AR (Wave II-KSC, LaRC, ARC, DFRC; Wave III-GSFC)
- SF224/GL/Reporting

Human Resource Transition Schedule by Service

NASA Shared Services Center
Customer Focused

NASA Shared Services Center



Support to Personnel Program

- Drug Testing
- Special HR Studies
- Classification Appeals
- Employee Notices
- HR Advisory Srvs
- Develop Info Materials
- Support for HR Automated Syst
- General Employment Inquiries
- Award Processing
- Agency Honorary Awards

HRIS

- HR & Training Website Dev & Maint
- Report Preparation
- User Support/ Expertise for Center HR Data Syst
- HR/ Training Information Syst

Employee Development and Training

- Training Srv Support
- Support to Surveys
- Admin of Online Training
- Off-site Training
- Training Data Entry
- Admin of Training Data Syst
- Processing Training Notices

Employee Benefits

- Health Fairs
- Financial Disclosure
- Leave Donor&Adv Sick Leave
- Benefits Processing
- New Hire In-Processing

SES Case Doc

- Rank Awards
- Appointments

Recruit

- Recruitment Logistics

PAP

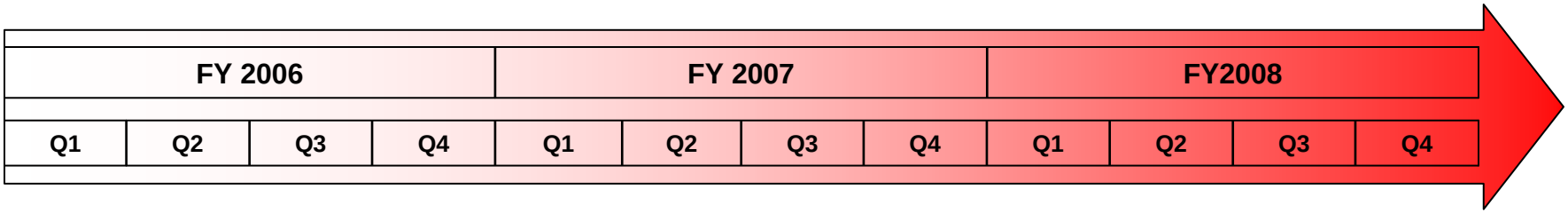
- OPF/ Performance Record Maint
- Personnel Action Processing

PCS

- PCS / Relocation Assistance

Procurement Transition Schedule by Service

NASA Shared Services Center
Customer Focused



Procurement Services

- Agency Bankcard Program
- SRBA Support Act
- 1102 Training Program
- Proc Customer Surveys
- Proc Intern Program
- Agency Contracting
- E-Procurement

SBIRs / STTRs

- SBIRs and STTRs (Wave I-ARC, DFRC, GSFC, SSC)
- SBIRs and STTRs (Wave II-MSFC, GRC, JSC, KSC, LaRC)

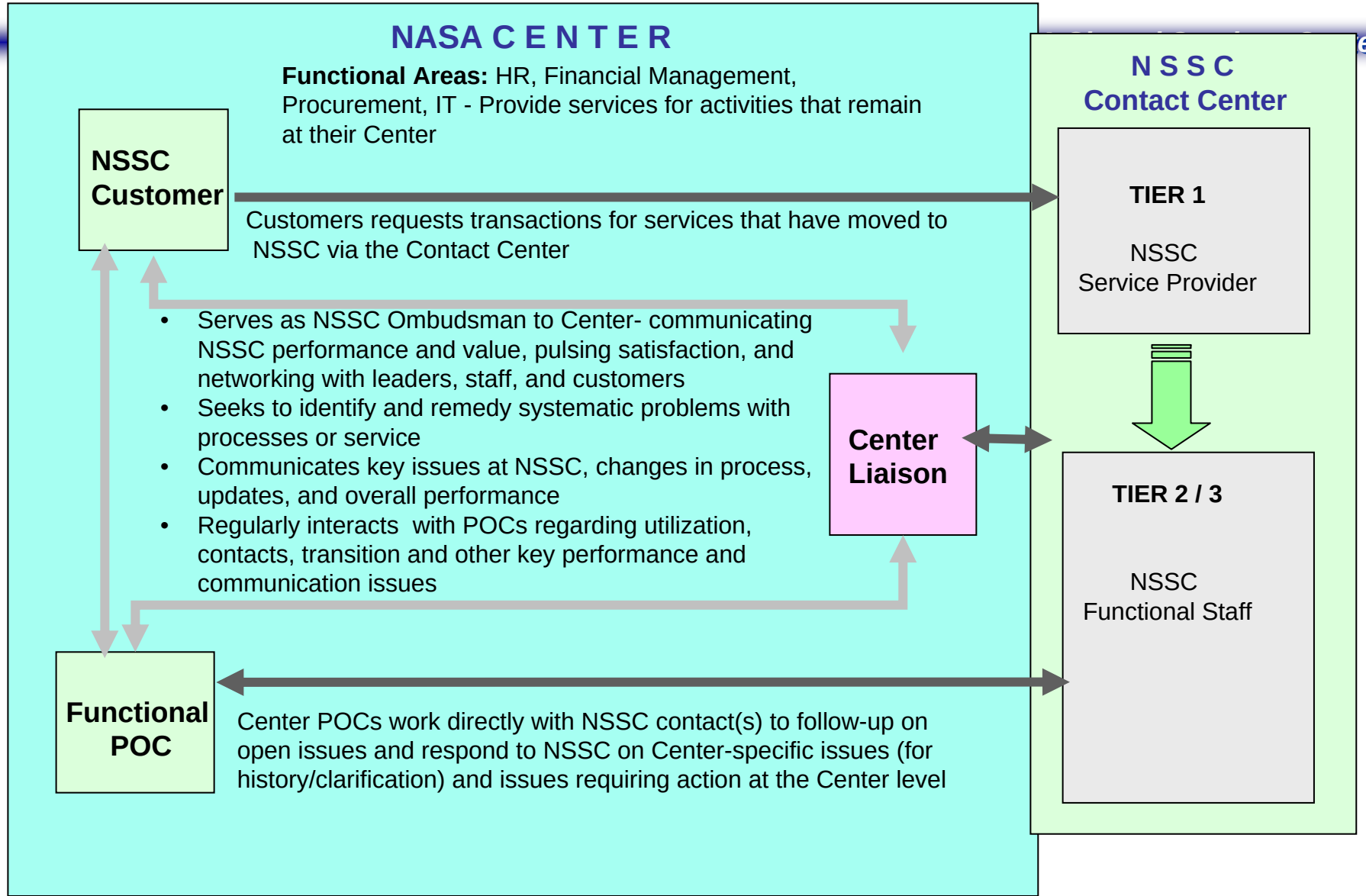
Training

- Training Purchases

Grants / Coop Agreements

- Grants/ Coop (Wave I-DFRC, GSFC, HQ, JPL/NMO, SSC)
- Grants/ Coop (Wave II-ARC, GRC, JSC, LaRC, KSC, MSFC)

Center Liaison



MSFC's Transition Team (key members)

- Led by Jim Ellis
- Functional POCs
  - John Alexander (FM)
  - Mack Blackman (HR)
  - Elaine Hamner (PR)
  - Sheila Fogle (IT)
  - Diane Cain (CM)

NSSC Customer Contact Center (CCC)

Support Hours

8am – 8pm Eastern
7am – 7pm Central
5am – 5pm Pacific

Monday through Friday

Best-of-class Customer Service

Answer questions & resolve issues regarding:

- **Financial Management**
- **Human Resources**
- **Procurement**
- **NSSC IT services**

NSSC Customer Contact Center (CCC)

How to contact the Customer Contact Center

Call **1-877-NSSC123 (1-877-677-2123)**

E-mail nssc-contactcenter@nasa.gov

Web interface to submit issues
Web self-service coming soon
(http://www.nssc.nasa.gov) Click Customer Service, Contact Us, Submit Inquiry

After Hours On-call CCC Manager

Center Liaison contact information

Cathy A. Fletcher

Mail Stop 4200/G35

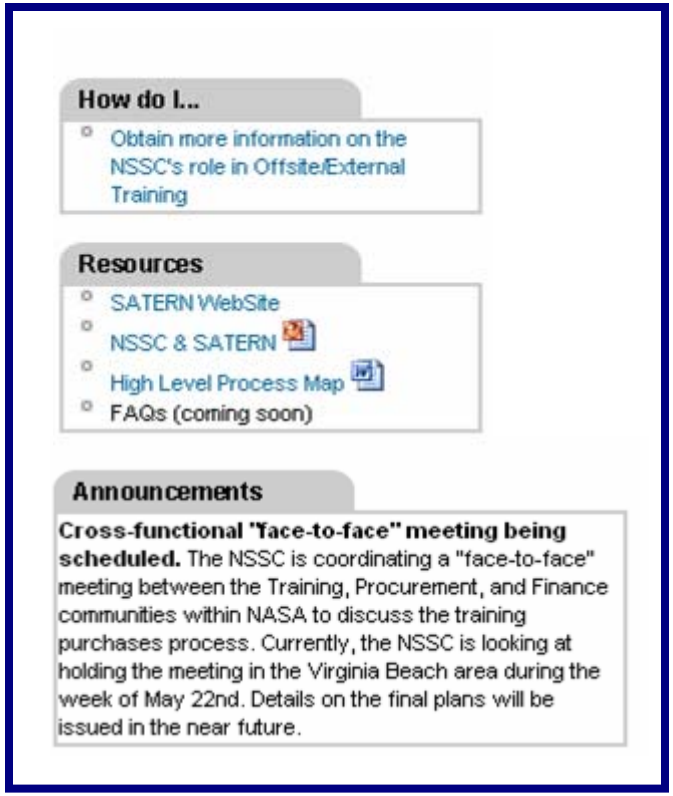
Bldg. 4200, room 305

256-544-7752

256-544-4809 (fax)

Where Can I Get More Information?

- NSSC Customer Service Web Page
  - http://www.nssc.nasa.gov/
    - Select Customer Service
    - Select Human Resources
  - "How Do I…?"
    - Event driven Q & A's
  - Resources
    - Forms
    - FAQ's
  - Announcements
    - Updates on process changes or new events



Questions?

OHC Client Learning Topic: Understanding the 'Excellence in Engineering' Initiative

EXPERIENCE BASED KNOWLEDGE TRANSFER ACTIVITIES

Jim, Bob, and Luke

October 25, 2006

Agenda

- Purpose
- Activities
- Schedule
- Synopsis of Courses
  - Lessons Learned
  - Space Launch and Transportation Systems (SLaTS)
- Excellence in Engineering

Purpose

- Provide insight into our activities
- Explain what Engineering wants to improve
  - Technical Understanding and Execution
  - Partnership with the Projects
  - Individual and Organizational Culture

Our Activities

EXPERIENCE BASED KNOWLEDGE TRANSFER ACTIVITIES

HUMAN CAPITAL DEVELOPMENT
Identifying Needs
Developing Approaches

DESIGN PROCESS
Characterization
Teaching
Improvement

ENGINEERING SPACE SYSTEMS
Experience Base
Consulting & Mentoring

PUBLICATIONS

- NASA TPs
  - Launch Vehicle Design Process (Update)
  - Lessons Learned (D)
  - Coaching & Mentoring (D)
  - Sensitivity / Uncertainty (D)
- SLaTS Textbook
  - Chapters and editing for AF Academy group book
  - Integrate extensive MSFC authorship
  - CD distribution
- Systems Engineering Text
  - Advisors
  - Providing Examples

COURSES

- Space Launch and Transportation Systems Design (SLaTS)
  - Taught monthly
  - e-Based version (D)
- Lessons Learned
  - Taught monthly
  - e-Based version (D)
- CSSI Workshops on LV Design Process
- Coaching & Mentoring
- Learning Organizations
- Sensitivity / Uncertainty / Margins (D)
- Leadership Principles
- Engineering Insight

STRATEGIES AND FRAMEWORKS

- Engineering Excellence Strategy
- Organizational Culture
  - Client Solutions
  - Succession Planning
  - Learning Organization
  - Leadership
- MSFC PMDP
  - Project Manager
  - System Engineer
  - Discipline Specialist
  - Functions
  - Competencies
  - Training/Experience Requirements
- APPEL Support
  - Operations Strategy
  - Technology Adaptation
  - Engineering Develop. Process

PROCESS MODELING AND TOOLS

- Design Process
  - Characterization
  - Improvement

  Focus
  - Interactions
  - Transformations
  - Functional Analysis
- Sensitivity / Uncertainty / Margins Modeling
- e-Based Lessons Learned Knowledge Transfer
- Advanced Learning (FT) Environment
  - Content for HQ/LaRC interactive virtual reality site
- Integrated Information and Communication System

ADVISING AND MENTORING

- MSFC Engineering
  - Engineering Dir.
- MSFC Projects & Staff
  - Shuttle Projects / RTF
  - Exploration Initiative
    - Integration Planning
    - Engrg. Development
    - ADFT Consulting
    - LAS Flight Test
    - Interplanetary Prop.
  - Systems Mgt. Ofc.
  - S&MA
- Office of Human Capital
  - Org. & Leadership Dev.
  - Training & Incentives
- Technical Training Planning
  - APPEL Curriculum
  - Adv. Engineering Training Planning
- Student Launch Initiative

(D) = Publication/Course in development
Items in gray are previous activities.

6/27/06

Upcoming Schedule*

Nov-06						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Dec-06						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

* Similar for each month of next year

- Synopsis of Courses
  - Lessons Learned
  - Space Launch and Transportation Systems

LESSONS LEARNED IN ENGINEERING

James Blair, Robert Ryan, and Luke Schutzenhofer

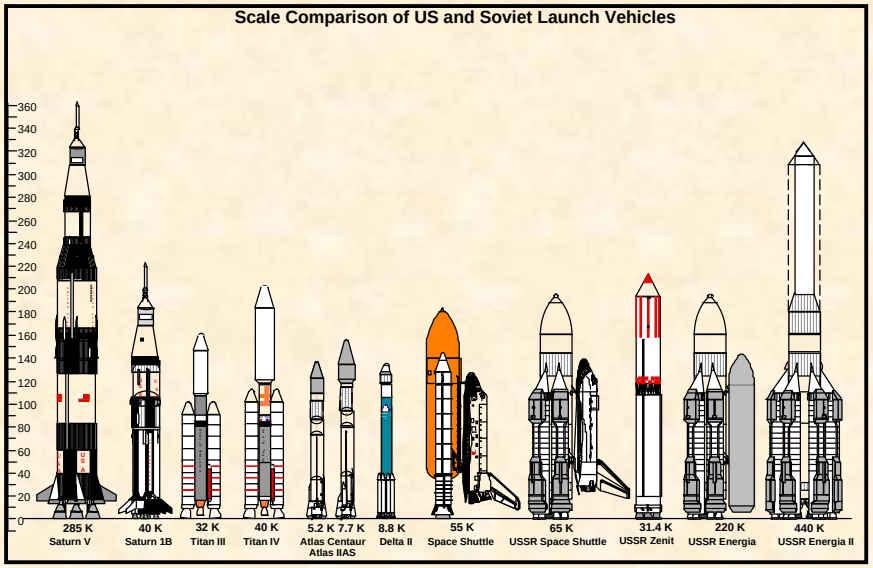
Contents

Course Objectives

- To provide principles learned from past aerospace experience to help achieve greater success in future programs.
- To identify through a workshop process the application of these principles.

Basis of Lessons

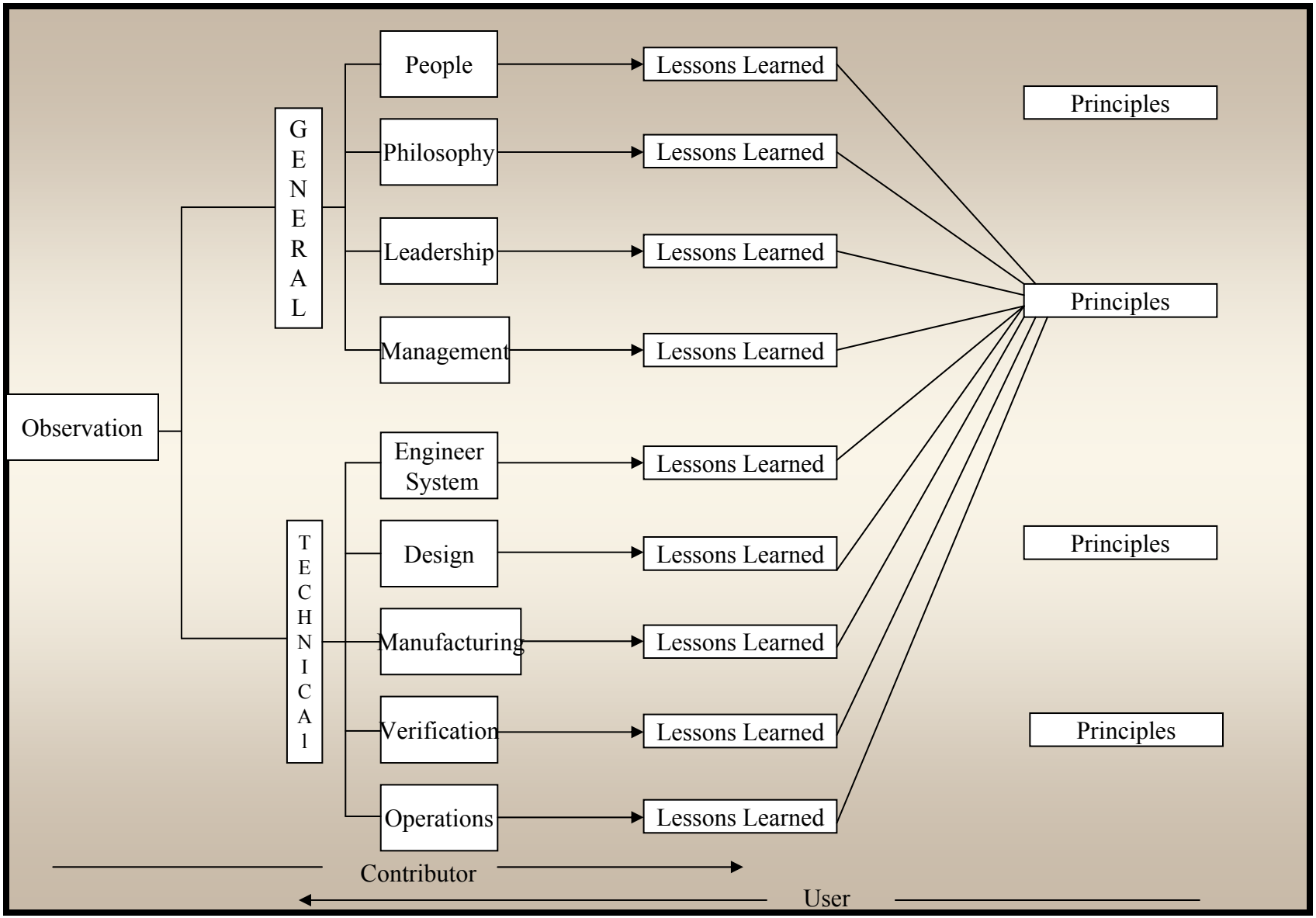
- **50 Years Experience in Aerospace Engineering.**
- **Programs**
  - **Redstone**
  - **Jupiter**
  - **Saturn I**
  - **Saturn IB**
  - **Saturn V Apollo**
  - **HEAO**
  - **Skylab**
  - **Hubble Space Telescope**
  - **Space Shuttle**
  - **X-33**
  - **Space Station**
  - **SLI**



Basis of Lessons

- The lessons presented are from the projects and activities the authors had experience with.
- Limiting our discussions to the lessons we worked allows us to present a first-hand experience; whereas if we included lessons from others it would be a second-hand experience.
- There are many other lessons and examples that the student should seek out.
- A disk is provided with the handout we have added a collection of some lessons obtained from other sources.

Lessons Learned Process



Lessons Learned Principles

- System success depends on the creativity, judgment, and decision-making skills of the people
  - People are our most important resource
- Space systems are challenging, high performance systems
  - High energy, high power density
  - Therefore, high sensitivity
- Everything acts as a system (whole)
  - We design by compartmentalization and reintegration
  - Understanding interfaces and interactions is crucial
  - Requires pervasive communications

Lessons Learned Principles - cont'd

- The system is governed by the laws of physics
  - Reality can't be ignored
  - Look to the real performance of the hardware and software
- Robust design is based on our understanding of sensitivities, uncertainties, and margins
  - Must consider sensitivities, uncertainties, margins, risks
  - Aim for robustness
- Project success is determined by life cycle considerations
  - Program constraints can result in a non-optimal design
  - Requirements can drive the design in unexpected ways
  - Early phases of project most influential on design
  - Design must consider full life cycle including manufacturing, verification, and operations

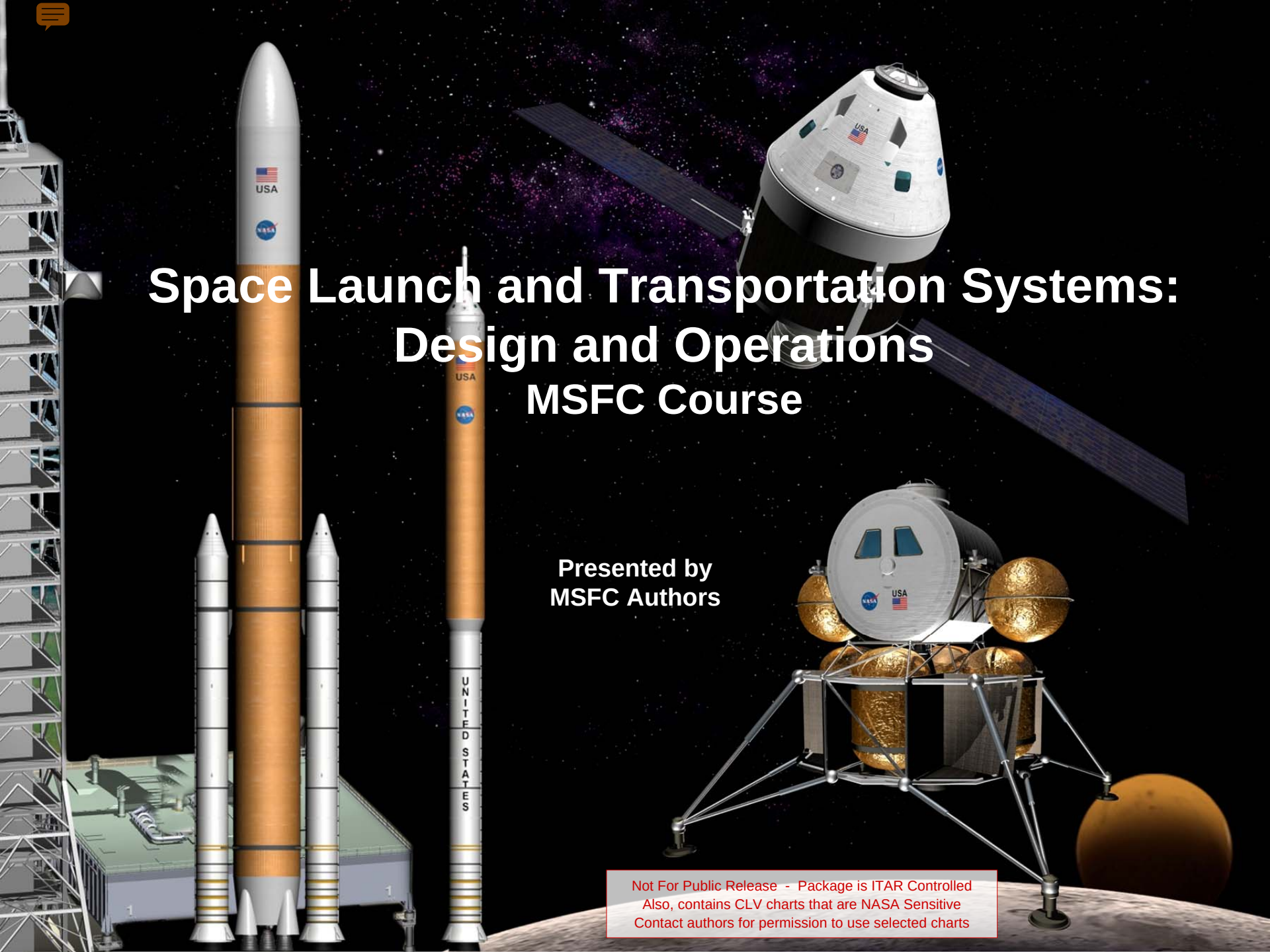
Lessons Learned Principles - cont'd

- Testing and verification have an essential role in development
  - We understand by testing
  - Must know limitations
- Anticipating and surfacing problems must be encouraged
  - Critical thinking
  - Think out of the box
  - Listen
- Leadership is the foundation
  - Integrity
  - Outward focus
  - People centered

Lessons Supporting Principles (p1 of 3)

Lessons Supporting Principles (p2 of 3)

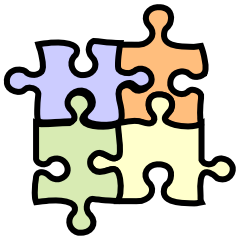
Lessons Supporting Principles (p3 of 3)



Space Launch and Transportation Systems: Design and Operations

MSFC Course

Presented by
MSFC Authors

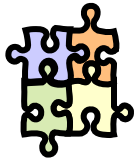


Objective, Background, Scope

Principles and Characterization of Design Process

Factors that Influence Design

Overview of Book and Course



Summary

SLaTS Course Objective

This course provides an integrated overview of space launch and transportation system (SLaTS) design and operations.

Emphasis will be on concept design and detail design for ARES I - V.

❖ What course is not:

- Does not provide technical details of the areas addressed, but provides principles

❖ What course is:

- Provides the process and critical issues of designing the system, and points to required details

❖ What you should expect to learn from course:

- The elements of space launch transportation system design
- What needs to be done to achieve an integrated system
- How your technical area fits into the system
- A sufficient understanding of other technical areas to understand your interactions with them
- Principles and lessons of “Design”

Background

- SLaTS course initiated from book ***Space Launch and Transportation Systems: Design and Operations*** to be published by Air Force Academy.

  - Part of 14-book ***Space Technology Series***

- Authorship from across government and industry, including 20 MSFC authors, many of whom will be course presenters.

- The course has been tailored for Constellation Program ARES I - V.

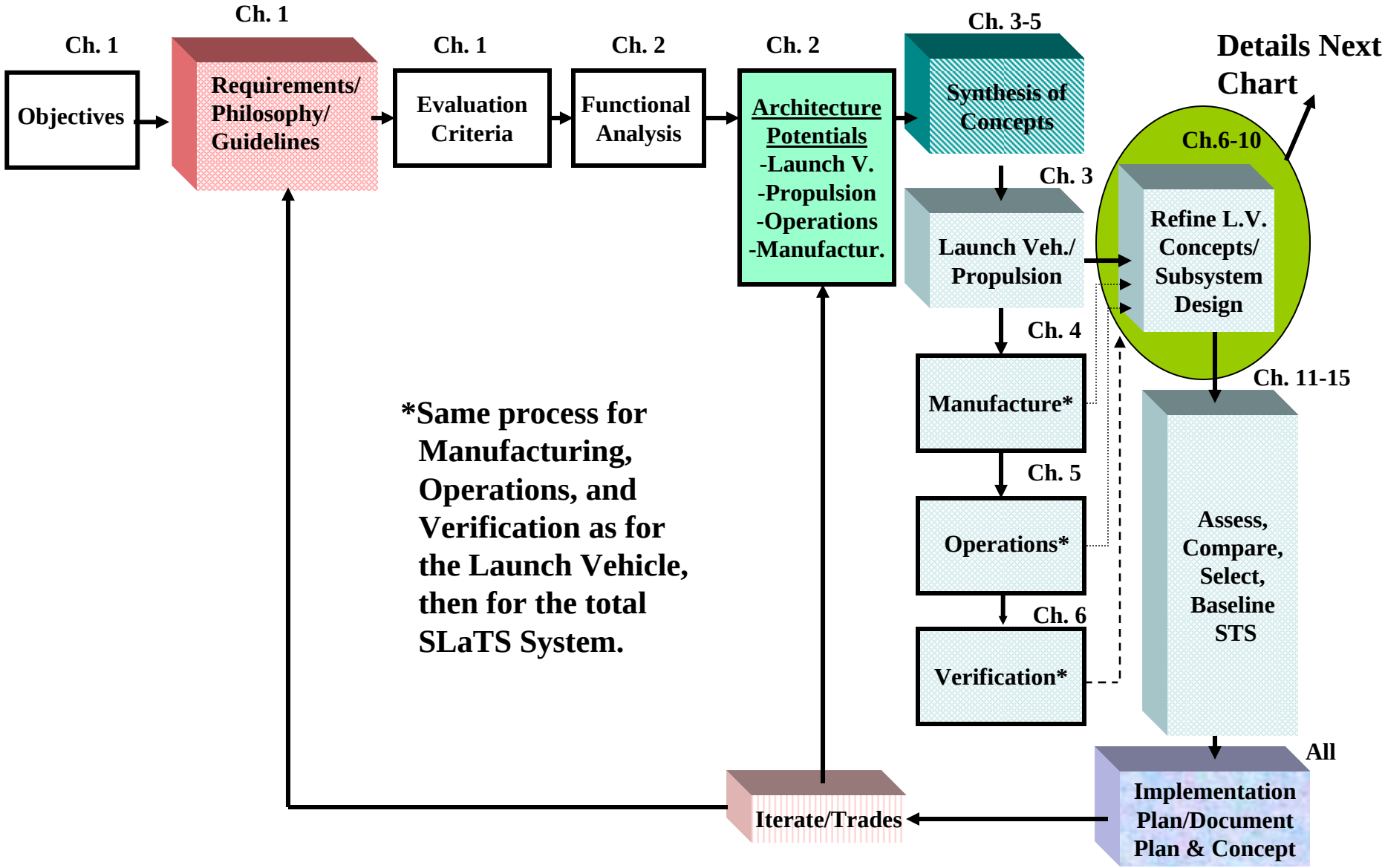
Scope of Book and Course

- **Book covers Concept Design. The system/subsystem design processes used in Concept Design also applies, at higher fidelity, in the Preliminary and Detail Design phases.**
- **Course will review Concept Design and will take forward look toward Preliminary and Detail Design for Ares-I / Ares-V.**

Course Content Tailoring

- **Course has been tailored for ARES application**
- **Content that is in handout, but will not be presented:**
  - **Life Support Subsystem (Chapter 10.6)**
  - **Economic Analysis of SLaTS (Chapter 12)**
  - **Regulatory Environment (Chapter 14.1)**
  - **Details of reentry/return aspects of design**
- **Allows more time for discussion of application of material**

SLaTS Book Process Flow



Space Launch and Transportation Systems - MSFC Course

AGENDA

Day 1 - Monday, October 16, 2006

8:30-9:00 **Course Objectives and Introduction**

Bob Ryan

9:00-10:30 **Space Transportation System Design Process Overview [Chapter 1]**

Bob Ryan / Jim Blair / Luke Schutzenhofer

10:45-12:00 **Creating Alternative SLaTS Architectures [Chapter 2]**

Dale Thomas

1:00-3:15 **Developing SLaTS Concepts and Configurations [Chapter 3]**

Rob Adams

3:30- 4:30 **Materials and Manufacturing for Launch Vehicles [Chapter 4]**

Robert Thom

Day 2 - Tuesday, October 17, 2006

8:30-9:30 **Creating Field and Flight Operations Concepts, Infrastructure Designs, and Logistics Plan [Chapter 5]**

Bob Ryan / Jim Blair / Luke Schutzenhofer

9:45-10:45 **Launch Vehicle Systems Engineering/Technical Integration [Chapter 6]**

Bob Ryan / Jim Blair / Luke Schutzenhofer

11:00-11:45 **Natural Environments [Chapter 7]**

Barry Roberts

Space Launch and Transportation Systems - MSFC Course

AGENDA - continued

Day 2 - Tuesday, October 17, 2006 - continued

12:45-1:45 **Principles and Processes of Launch Vehicle Aerodynamics [Chapter 8]**

Luke Schutzenhofer

Analytical, Functional, and Physical Integration; Induced Environments [Chapter 9]

2:00-2:05 **Chapter 9 Introduction**

Bob Ryan

2:05-4:30 **Performance and Trajectory Analysis [Chapter 9.1]**

John Hanson

Day 3 - Wednesday, October 18, 2006

8:30-9:30 **Loads [Chapter 9.2]**

Luke Schutzenhofer

9:45-11:00 **Thermal Environments [Chapter 9.3]**

Jim Owen / Mark D'Agostino

Subsystem Design [Chapter 10]

11:00-11:30 **Chapter 10 Introduction**

Bob Ryan

12:30-4:00 **Propulsion Systems [Chapter 10.1]**

Rick Ryan / George Young

Space Launch and Transportation Systems - MSFC Course

AGENDA - continued

Day 4 - Thursday, October 19, 2006

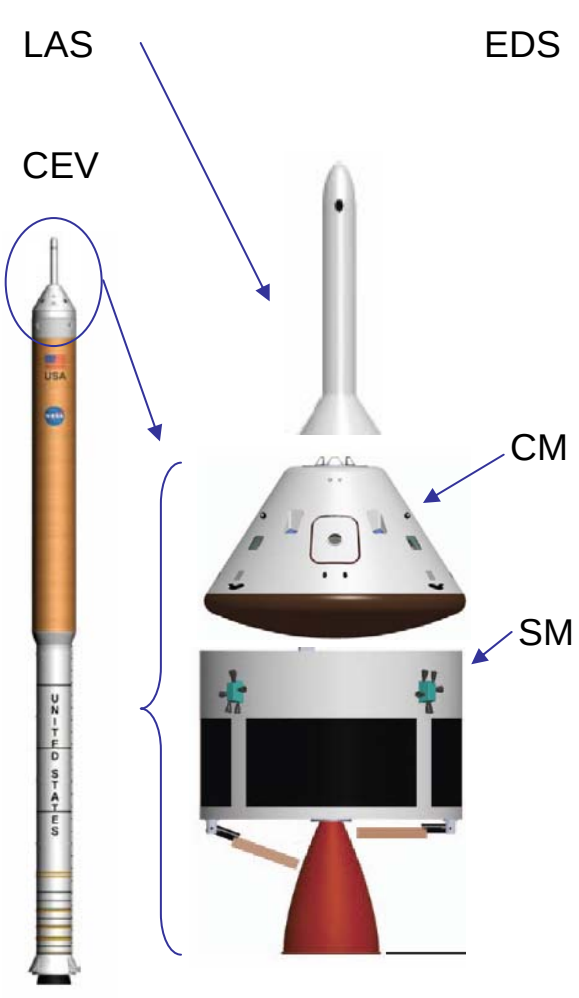
Subsystem Design - [Chapter 10] – Continued

8:30-10:15	**Avionics [Chapter 10.5] –** *Ken Schrock*
10:30-11:15	**GN&C Overview; Navigation and Guidance [Chapter 10.2] -** *John Hanson*
11:15-12:00	**Control Systems [Chapter 10.2]** *- Jim Blair*
1:00-2:00	**Structures [Chapter 10.3] -** *Erich Engler*
2:30-4:00	**Thermal Systems [Chapter 10.4] –** *Jim Owen / Bruce Tiller / John Sharp*

Day 5 - Friday, October 20, 2006

8:30-9:45	**Safety and Mission Assurance [Chapter 13]** *John Livingston / Mary DeMurray*
10:00-10:45	**Risk Assessment [Chapter 14.2]** *Luke Schutzenhofer*
11:00-12:00	**Life Cycle Cost [Chapter 11]** *Barbara Stone-Towns / Steve Creech*
1:00-4:00	**Engineering Excellence: Root Causes, Lessons Learned, and Solutions** *Bob Ryan / Jim Blair / Luke Schutzenhofer*
4:00-4:30	**Summary and Wrap-up** *Bob Ryan*

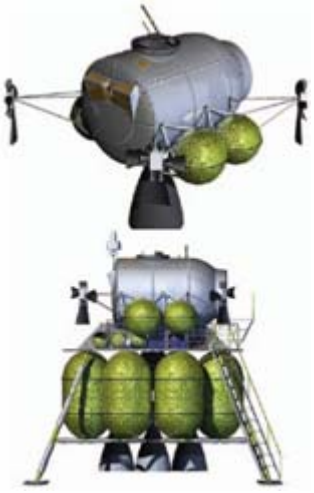
1.5 – Launch Vehicle Architecture Elements



Ares I

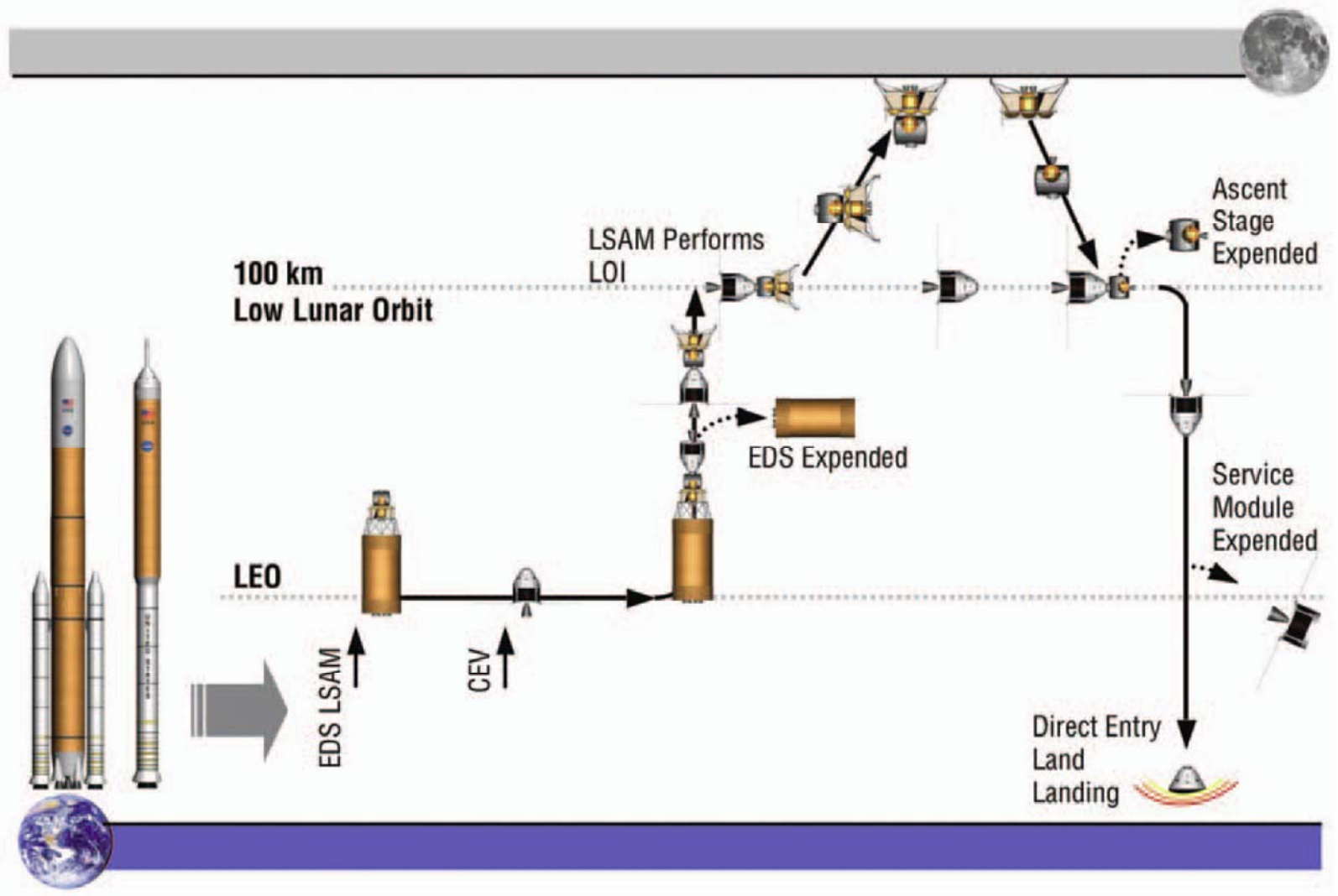
Ares V

EDS with CEV

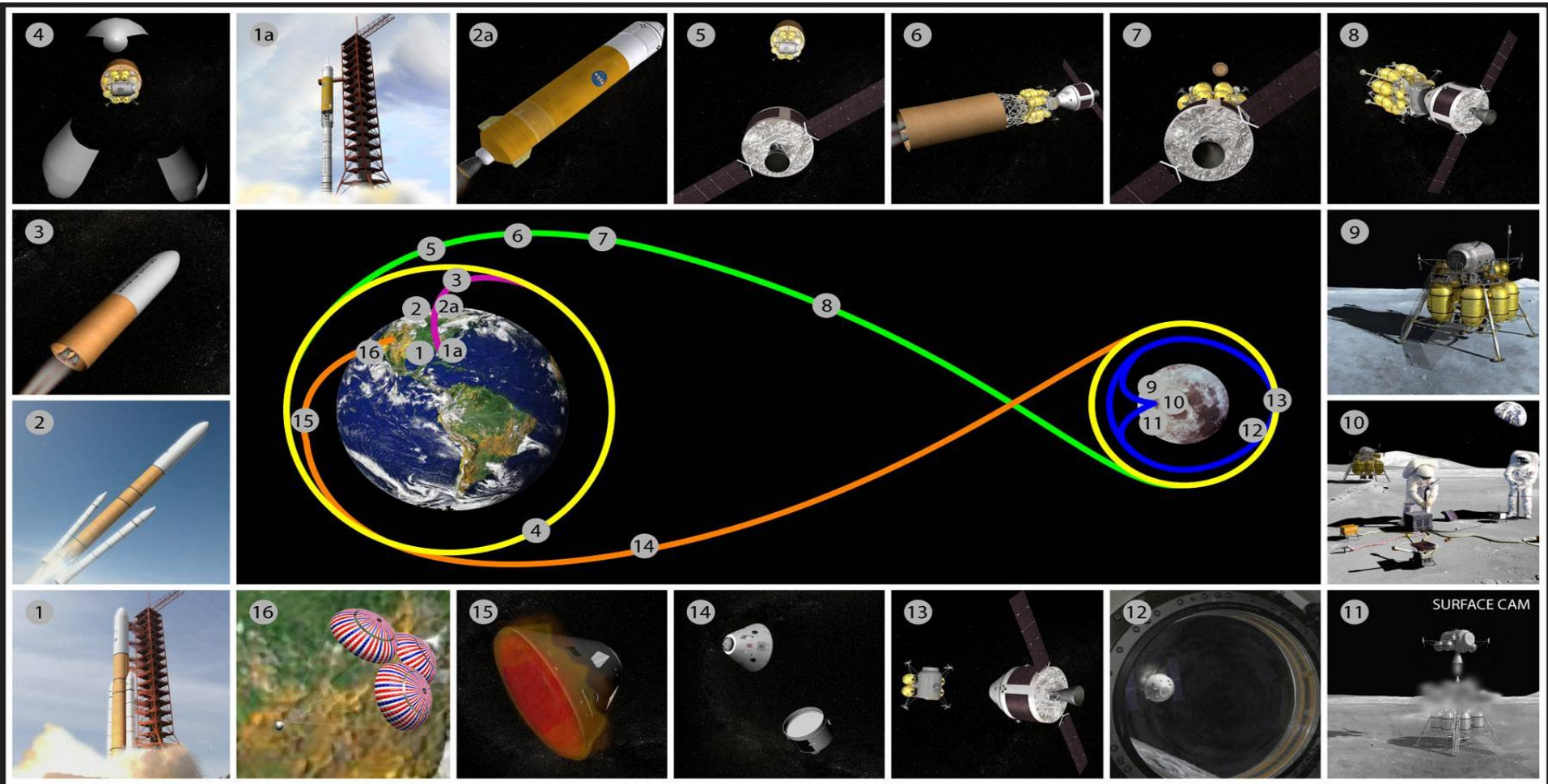


Lunar Descent and Ascent Stages

1.5 – Launch EOR-LOR Mission Architecture Illustration



EOR-LOR “1.5 – Launch” Mission Architecture



1. Cargo Launch Vehicle (CaLV) liftoff.
2. Solid Rocket Booster (SRB) separation.
3. Earth Departure Stage (EDS) fires for Earth orbit insertion.
4. Payload shroud separates to expose Lunar Surface Access Module (LSAM).

1a. Crew Launch Vehicle (CLV) liftoff.
2a. Upperstage fires for Earth orbit insertion.

5. Crew Exploration Vehicle (CEV) docks with LSAM and EDS.
6. EDS fires for lunar destination.
7. CEV and LSAM undock from EDS.
8. LSAM fires for lunar orbit insertion.
9. LSAM lands on lunar surface.
10. Conducting activities on the lunar surface.
11. LSAM ascent stage liftoff viewed from surface camera.
12. LSAM ascent stage prepares to dock with CEV.
13. LSAM ascent stage and CEV separate.
14. Capsule separates from service module.
15. Capsule reenters Earth's atmosphere.
16. Chutes open for landing and recovery in the Western U.S.

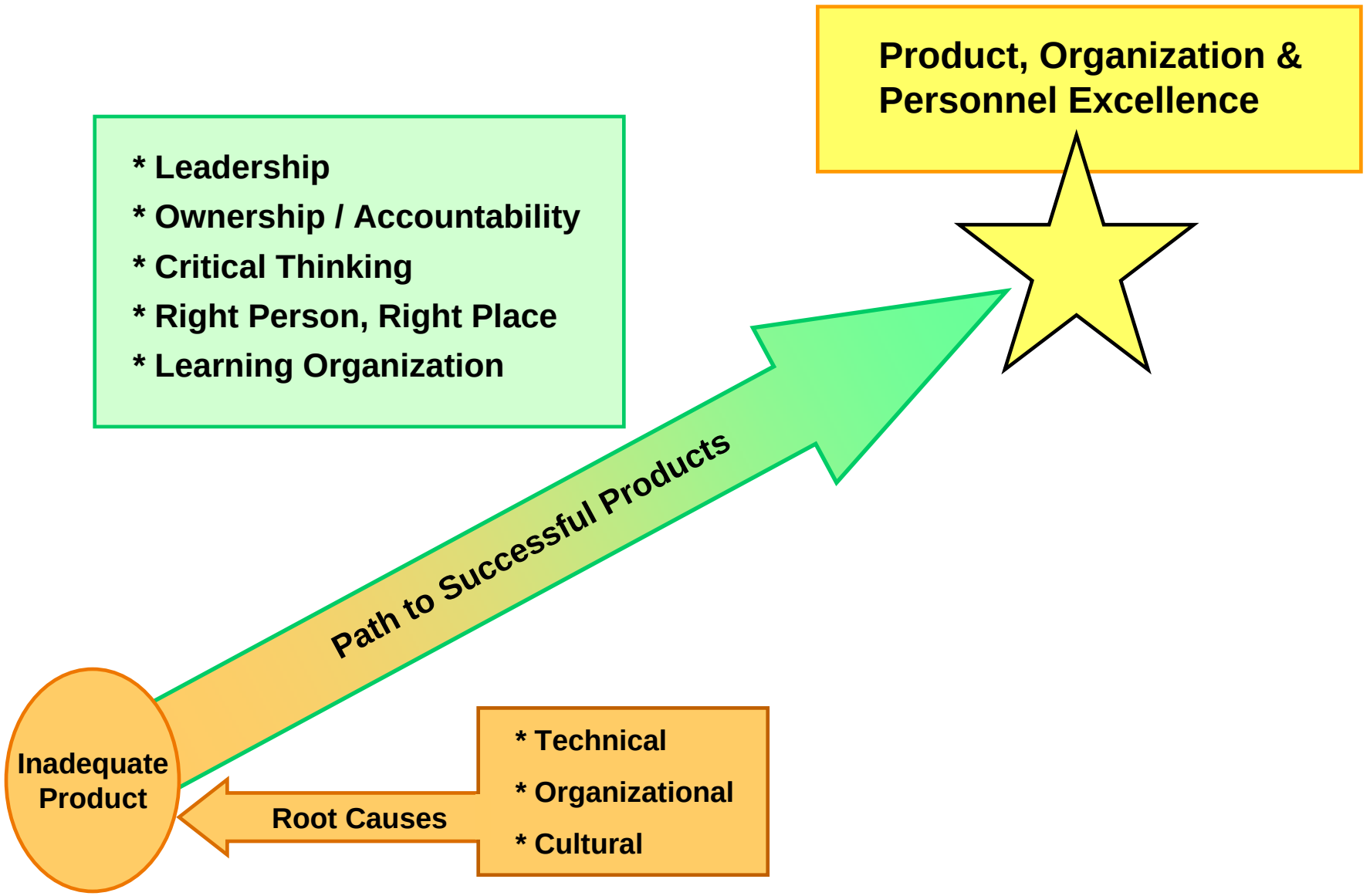
Principles of Engineering Excellence

Principles of Engineering Excellence

- Overview
- Problem Root Causes
- Solutions

Jim Blair, Robert Ryan, and Luke Schutzenhofer

Process for Excellence



Root Causes of NASA Failures/Problems

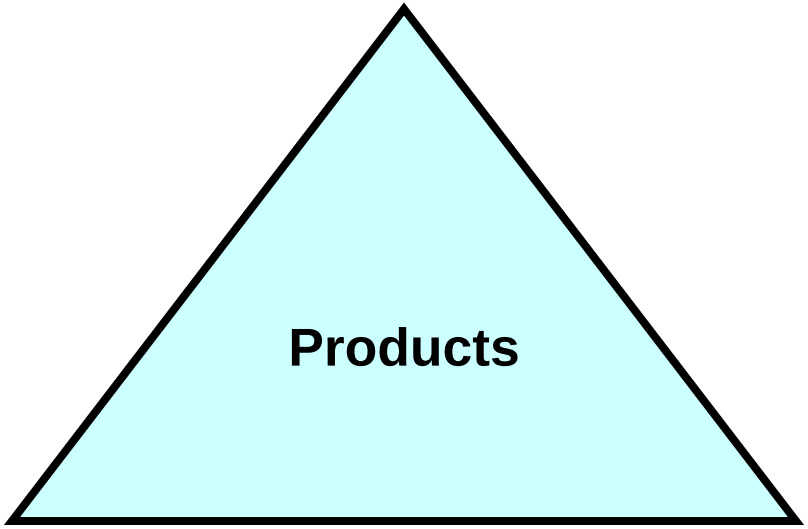
1. **Shifting from engineering “hands on” and “excellence” to “insight/oversight”. Lack of ownership**
2. **“Normalization of the deviances”. Not questioning anomalies.**
3. **Lack of critical thinking. Over-reliance on procedures and computer codes.**
4. **Decentralization of authority.**
5. **Organizational and technical complexity.**

Examples Supporting Root Causes

1. **Space Shuttle Challenger** (2, 4, 5)
2. **Space Shuttle Performance** (3, 5)
3. **Space Shuttle Columbia** (2, 3, 4, 5)
4. **Hubble Telescope Mirror** (1, 2)
5. **X-33 Single Stage to Orbit** (3, 5)

Elements of Engineering Excellence

Technical Understanding and Execution



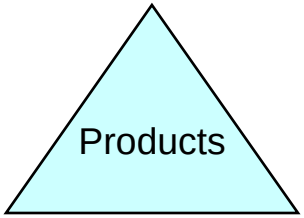
Partnership With Project

Individual & Organizational Culture

Elements of Engineering Excellence

Technical Understanding and Execution

- Understanding the Physics
- Technical Integration / T-Model
- Interactions and Interfaces
- Sensitivity, Uncertainty, Margins



Partnership With Project

- Technical Authority
- Requirements Management
- Risk Management
- Cooperative Solutions

Individual & Organizational Culture

- Ownership and Accountability
- Critical Thinking vs. Procedures
- Right People in Right Places
- Learning Organization

SIX PRETTY GOOD IDEAS

- Mike Rudolphi

Be Safe

Do It Now

Communicate

Leave It Better

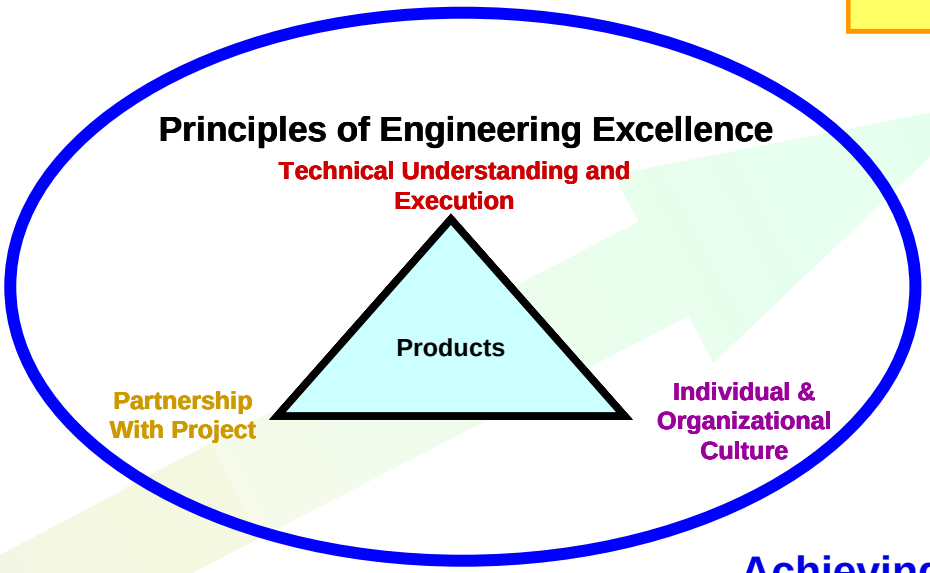
Engage

Make Yourself Better

Summary to Success

Product Success

Product, Organization & Personnel Excellence



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Achieving Product Success Requires Integration Of All Principles Of Engineering Excellence

It's Our Time

Application of principles of engineering excellence ameliorates root causes and achieves product success

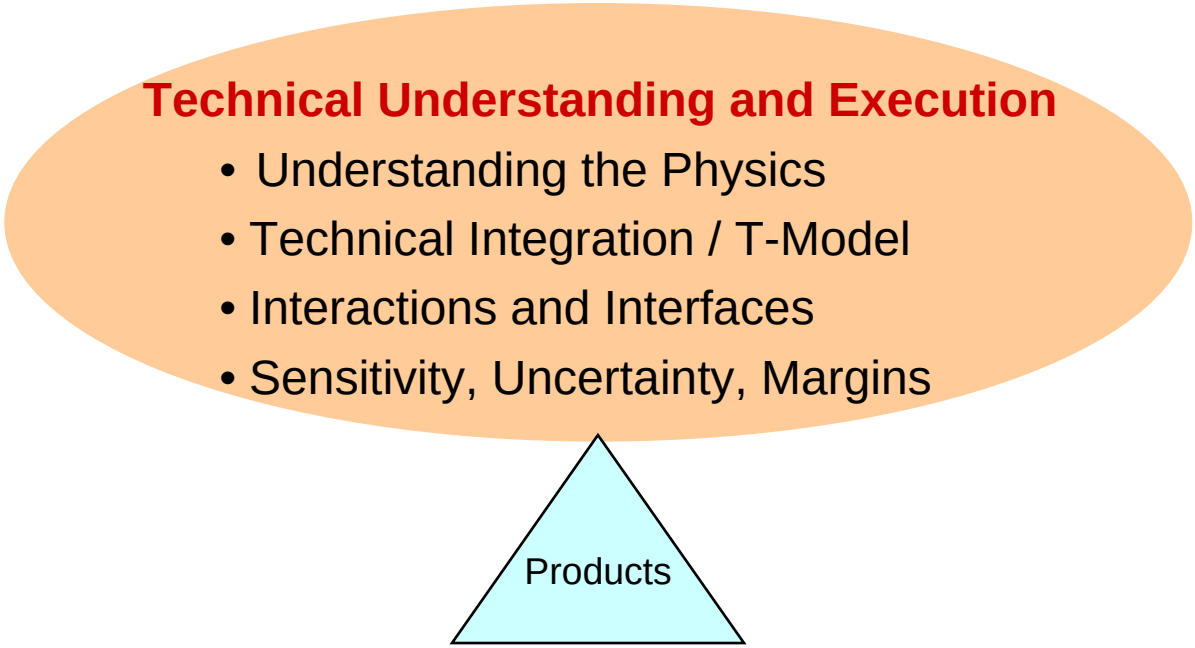
Future Team Integration Topics/ Wrap-Up

The topics you asked for:	The topics we've discussed:
Specifics on OHC programs	Succession Mgt, CMS, Awards, BRAC, NASA Game, Hiring Process,
Client learning topics	RTF Foam Team, ED workforce team, Shuttle Integration, S&MA,
Deeper understanding of IPTs	
Position Management	
Center Governance Model	
NSSC Overview	Cathy Fletcher
Who does what in OHC	

Backup

(Remainder of Charts on Engineering Excellence)

Elements of Engineering Excellence



Partnership With Project

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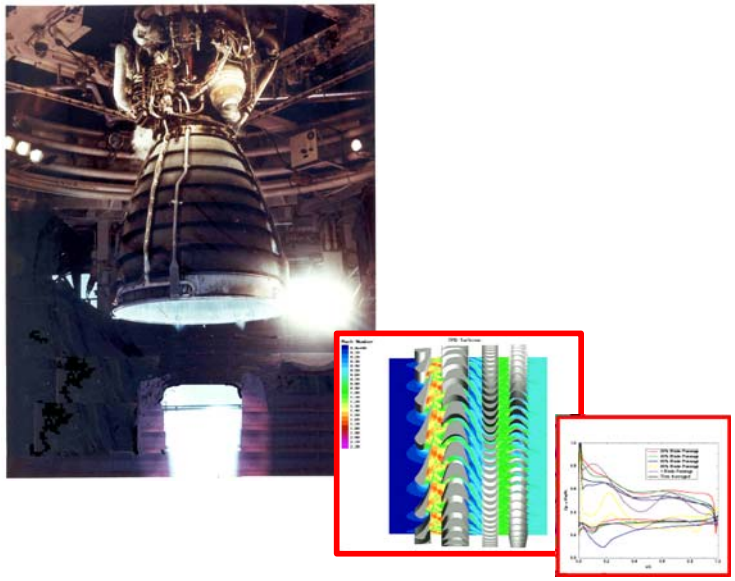
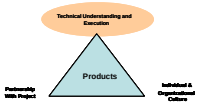
Understanding the Physics

- In-depth technical knowledge and expertise is essential and fundamental



- Technical experts should
  - Step back from the details and take a broad view of what is happening
  - Consider the real system vs. the model (Don't eat the menu)
  - Use simplified models to help understand the phenomena (If you can't explain it in simple terms, you don't understand it)
  - Explain the technical concepts and the significance of the results to the leadership

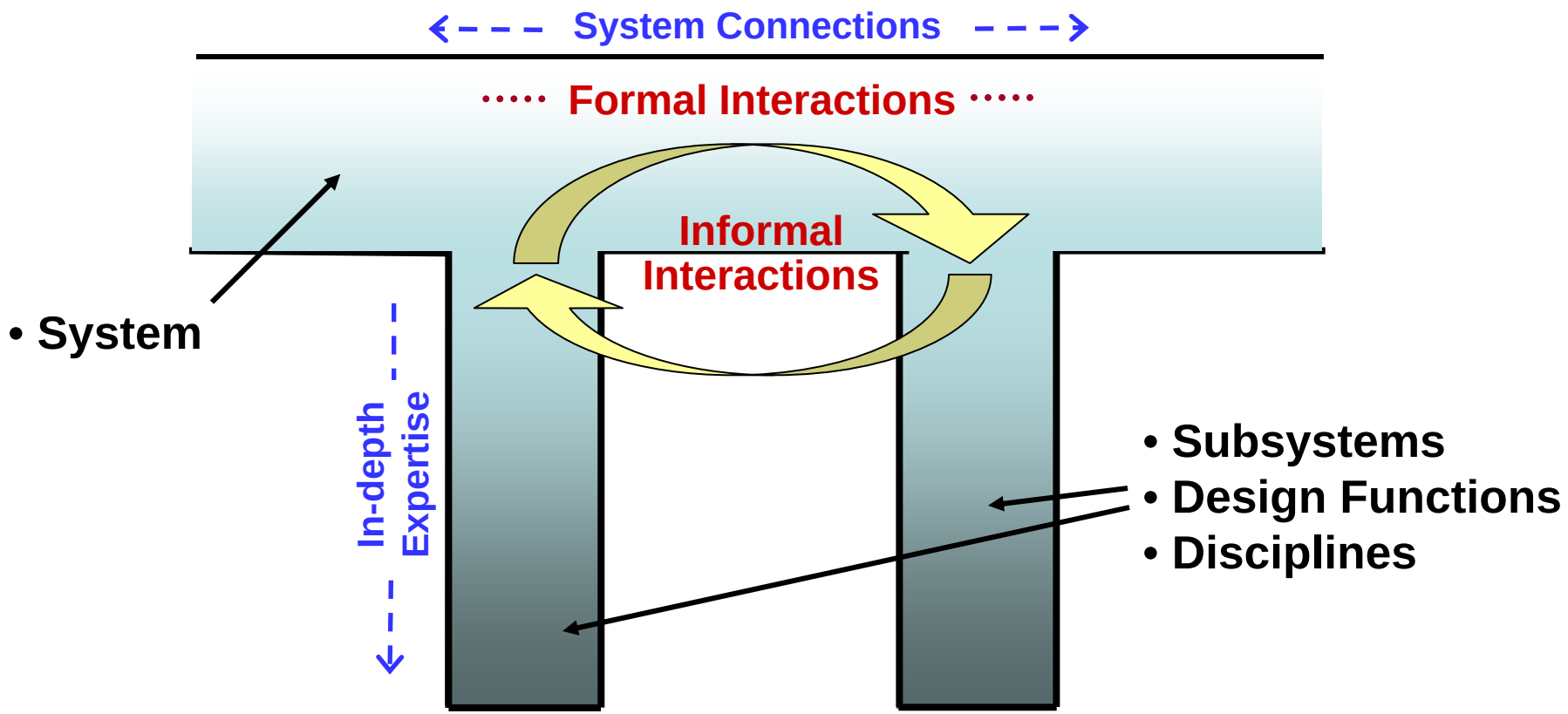


Technical Integration / T-Model

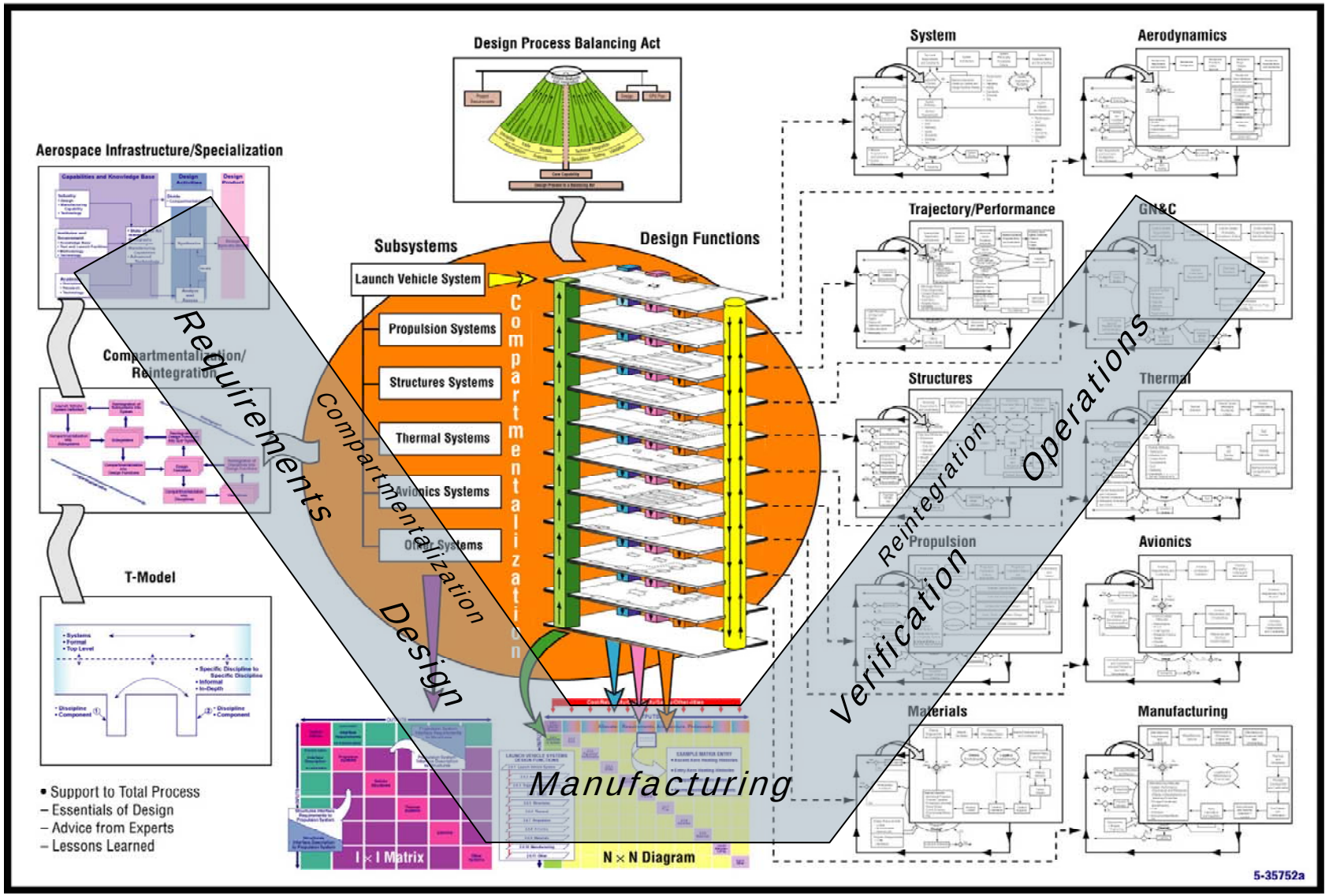
- Most (~80%) technical problems are <u>systems</u> problems
  - Occur because of interactions, interfaces, communications breakdown

- For successful systems, engineers and managers must
  1. Have in-depth technical expertise overarched by a systems view (T-model)
  2. Understand and execute the compartmentalized/reintegrated interactive design process (Technical Integration)

T-Model for Technical Integration



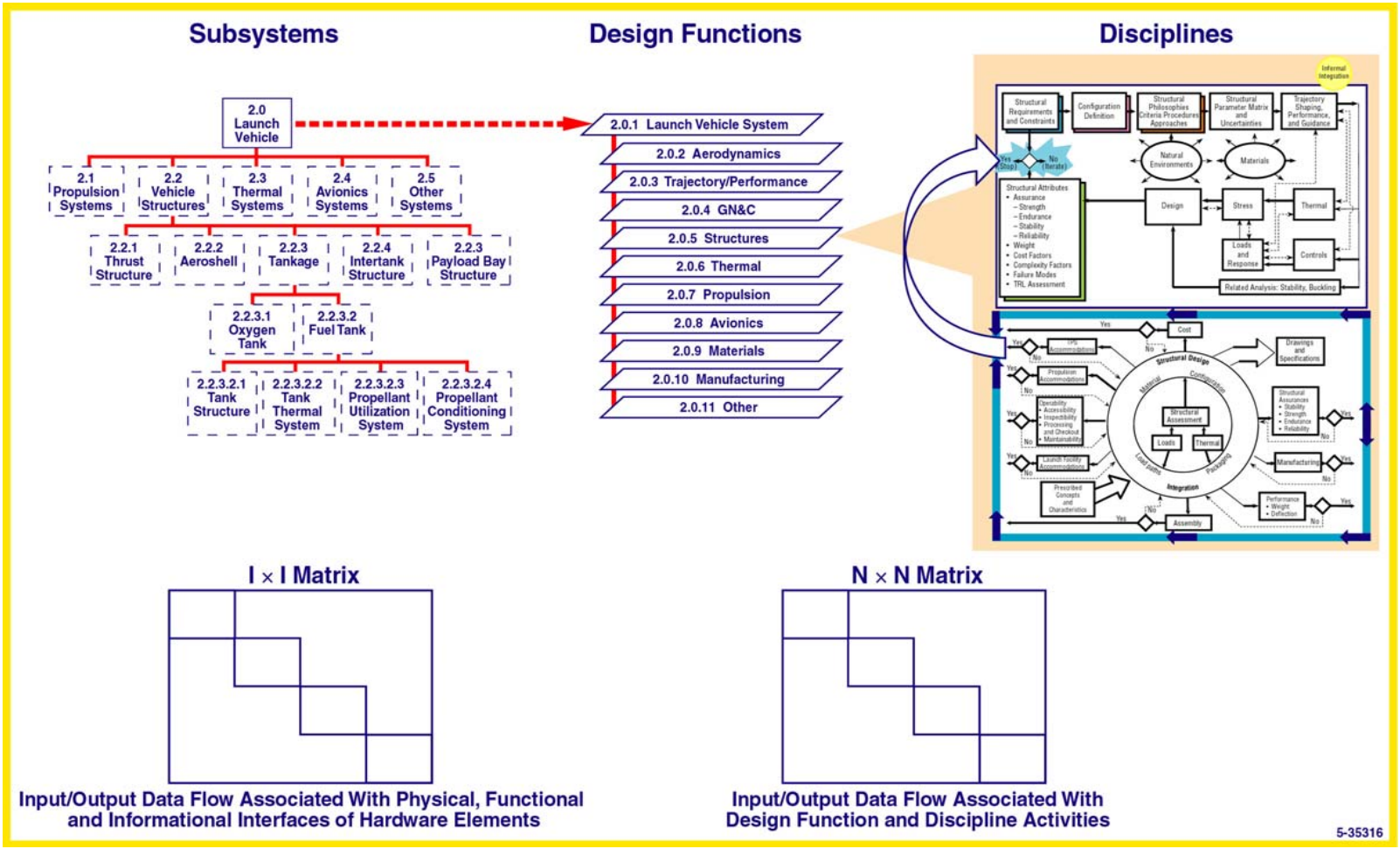
Technical Integration – Design Process



Interactions and Interfaces

- Our complex systems are highly interactive
  - What happens in one subsystem or area can affect other subsystems or areas in unexpected ways
- For successful systems, engineers and managers must
  1. Give much attention to potential interactions
  2. Manage the interfaces and data flow – identify responsibilities
  3. Have robust informal communications with all disciplines
- Organizational interactions/communications are just as complex and important as the technical and require the same level of attention

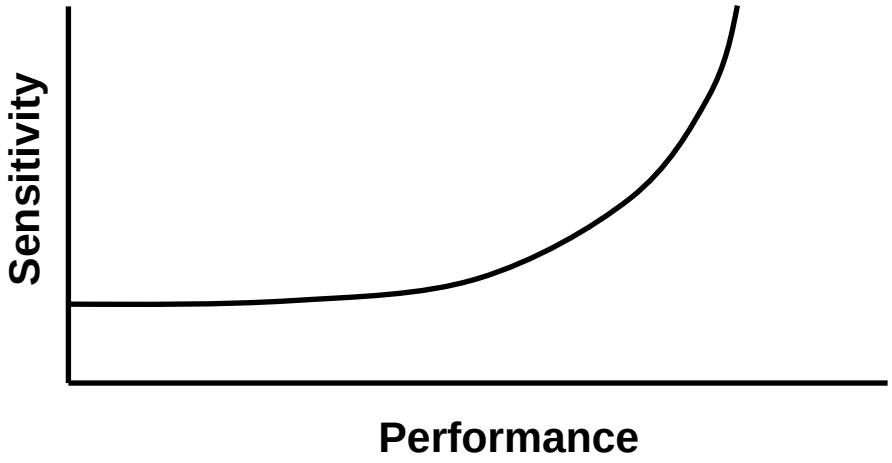
Interactions and Interfaces



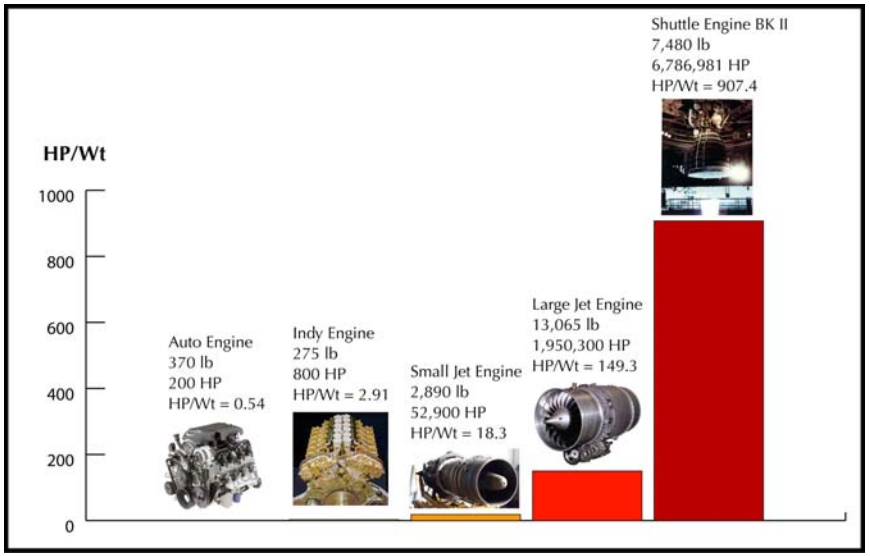
Matrices of Input/Output Data Flow

Sensitivities, Uncertainties, and Margins

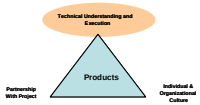
- High performance systems are sensitive systems
- The higher the performance, the greater the sensitivity



Power density comparison of automobile, jet, and rocket engines



- Launch vehicles are high performance systems
  - Attain and dissipate orbital energy
  - High power density



Sensitivities, Uncertainties, and Margins
continued

For successful systems, engineers and managers must

1. **Quantify system sensitivities. Sensitivities should always be calculated along with nominal predictions. De-sensitize system where possible.**

2. **Understand uncertainties and parameter variations in the system and environments**

3. **Manage margins. Provide adequate margins according to historical data, project phase, and maturity of technology. Margin management and risk management are coupled. (Requires developing and tracking metrics)**

Elements of Engineering Excellence

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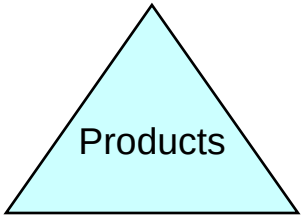

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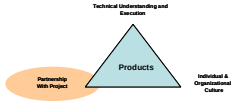
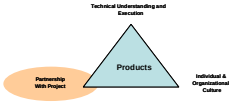


Technical Authority

- Engineering is the Technical Authority for MSFC projects.
- Engineering is the technical conscience that ensures the technical correctness of the product.
- This means taking "Ownership and Accountability" of the technical performance of the product.
- Engineering has ownership and accountability in all government roles (in-house or prime contractor design).
- Ownership role internalized and asserted by Engineering, understood and relied on by Projects.



Progression of Ownership

Observer

Spectator
Critiquer

Participant

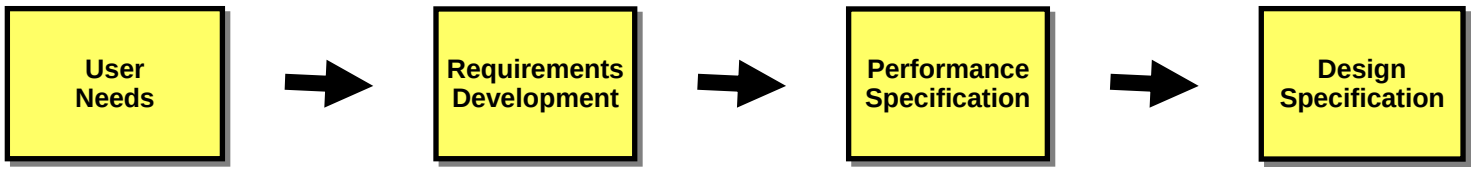
Doer
Shared Responsibility

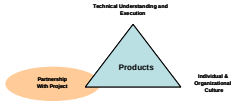
OWNER

Doer
Sole Responsibility

Requirements Development and Management

- Project and Engineering are cooperatively responsible for the development and management of requirements. Engineering is the major source of requirements
- Unrealistic and technically uninformed requirements have been the source of major problems
  - Demand to understand the requirements
  - Push back on unreasonable requirements
- On the other hand, resist tendency to “over-engineer” the system
  - *Better* can be the enemy of *good*
  - Use judgment on when enough is enough

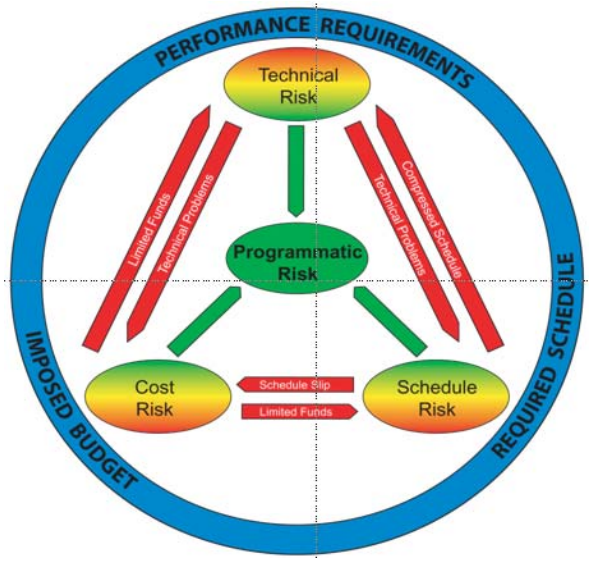




Risk Management

- **Engineering is in partnership with the project in defining, accepting, and managing risk**

  - Primary source for assessing technical risk, and cooperatively assessing cost and schedule risks



- **Technical, cost, and schedule risks are inherently coupled**

- **Engineering manages, accepts, and owns the risks jointly with the project, unless risk is technically unacceptable to Engineering.**

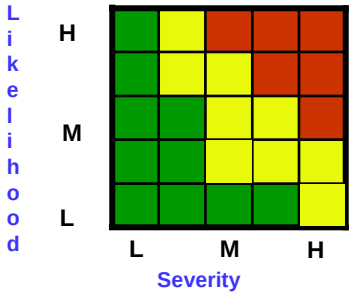
Risk Management

Risk Assessment

Traditional Risk Assessment
(design basis evaluations) c

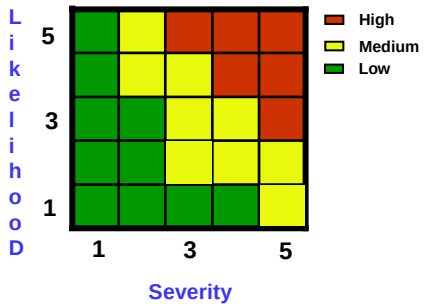
Modern Probabilistic Risk Assessment
(risk-significant scenarios)

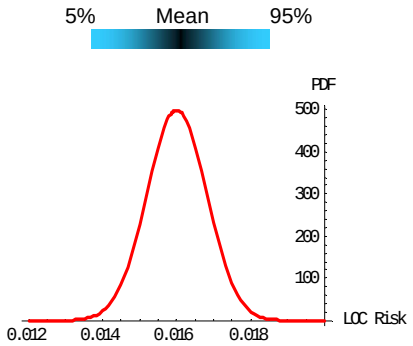
Qualitative Risk Assessment



Subjective/Expert Judgment

Quantitative Risk Assessment





Risk of LOC

"Objective"/Data

Supporting Tools

- Failure Modes and Effects Analyses
- Master Logic Diagram
- Event Sequence Diagram
- Event Tree
- Fault Tree Analysis
- Reliability Block Diagram

Risk Management

Risk Assessment

Traditional Risk Assessment
(design basis evaluations)

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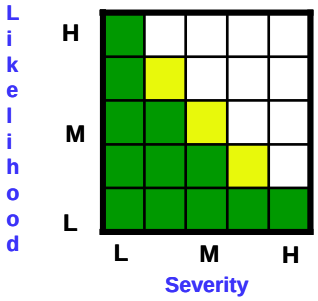
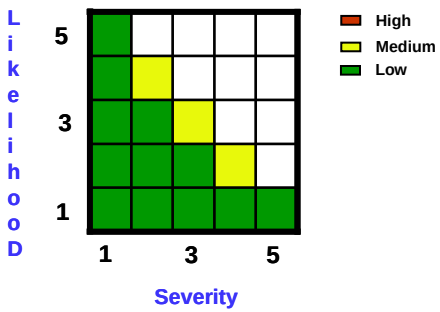


Quantitative Risk Assessment



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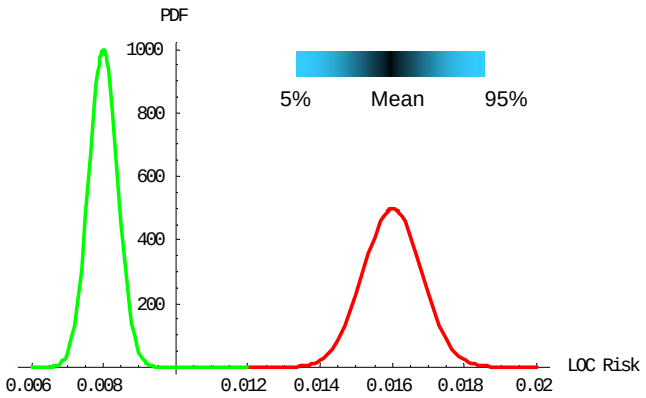

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Supporting Tools

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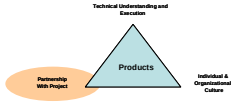
- Event Tree
- Fault Tree Analysis
- Reliability Block Diagram
- Cost and Schedule



Cooperative Solutions

- Engineering works cooperatively with the Project to achieve a balanced solution
  - Technical, cost, schedule, -ilities
- Engineering must be proactive up front to include cost, schedule, -ilities in the design

Elements of Engineering Excellence

Technical Understanding and Execution

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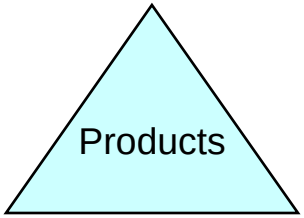
- Technical Integration / T-Model
- Interactions and Interfaces
- Sensitivity, Uncertainty, Margins



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- Right People in Right Places
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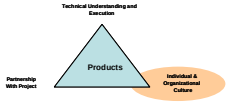
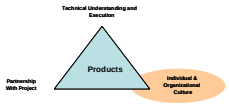


Individual & Organizational Culture

- **Ownership and Accountability**
- **Critical Thinking**
- **Right People in Right Places**
- **Learning Organization**



Ownership and Accountability for Design

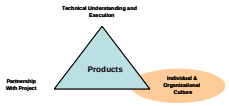
BUILDING OWNERSHIP

Role of Leadership

- **Primary role of leadership is developing people – teaching, mentoring,…**
- **Encourage and allow team and individuals to serve as primary accountability mechanism**
- **Leader is not the only source of discipline, but is ultimate arbiter of discipline**
- **Set boundaries of accountability**

Principles of Development of Individuals

- **People become what you expect of them**
- **You get what you reinforce in people**
- **Praise 10 times for every time you criticize**



Ownership and Accountability for Design

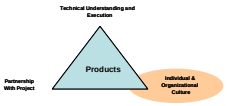
BUILDING OWNERSHIP

Role of Individuals

- **Competence – Develop and enhance my skills and capabilities**
- **Cognizance – Penetrate understanding of the design with critical thinking**
- **Commitment – Be dedicated to my task**
- **Accountability – Be responsible for my product**
- **Passion – Feel the pride of ownership**

Progression of Ownership

Observer/Critiquer → **Participant** → **OWNER**



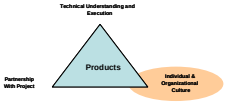
Ownership and Accountability for Design

BUILDING OWNERSHIP

Role of Teams

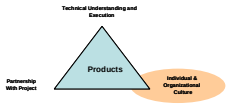
- **Team members hold one another accountable**
- **Encourage poor performers to improve**
- **Identifies potential problems quickly by questioning one another's approaches without hesitation**
- **Establishes respect among team members who are held to the same high standards**
- **Team leader must provide clear focus and make necessary decisions (be in charge)**

Openness based on trust founded in integrity



Ownership and Accountability for Design

Ownership and accountability are cooperative efforts among the Leadership, Individuals, and Teams



Critical Thinking

What are the elements of critical thinking?

Individual

Knowledge and Understanding of “How things work”

Not solely relying on procedures, processes, codes

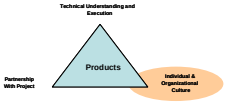
Challenging assumptions etc., question yourself

Inquisitiveness, don’t be afraid to ask questions

Passion

Skill enhancement (Competency)

Critical thinking is not sequential but integrated



Critical Thinking

What are the elements of critical thinking?

Organizational (See Learning Organization)

- **Vision/Focus**
- **Questioning**
- **Feedback**
- **Not solely relying on procedures and processes**
- **Giving recognition to critical thinkers**
- **Support & encouragement**
- **Peer interactions and reviews**

Organizational Questions To Induce Critical Thinking

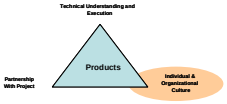
1. What are/were we trying to accomplish? (The Objective)
2. How well did we/you execute the plan? (Administrative)
3. What happened? (Descriptive)
4. Why do we/you think it happened? (Diagnostic)
5. What alternatives are there? (Creative)
6. What do we/you think will happen? (Predictive)
7. What is the best choice? (Evaluative)

Our learning goal is to ensure that these questions are asked at all levels in the organization (Adapted from the NYPD Comstat model)

Technical Questions To Induce Critical Thinking

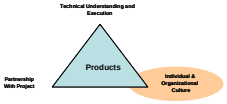
1. How does the system work? What are the physics of the problem?
2. What can go wrong?
3. What are the consequences?
4. What are the risks associated with the system?
5. How can risks be mitigated?
6. What are the assumptions in any analyses or tests?
7. What are the Interactions with other systems? Other disciplines, etc?
8. What are the performance sensitivities, uncertainties, and margins?
9. What is the data really telling us?
10. What is the underlying pattern?
11. Is the intuition not satisfied -- Do you feel uncomfortable?

❖ ***Don't be afraid to ask questions; it is not a sign of weakness.***



Getting the Right People in the Right Places

- **Each person's talents are enduring and unique.** Ref. 8
- **Each person's greatest room for growth is in the area of his or her greatest strength.** Ref. 8
- **Find your voice, inspire others to find their voice.** Ref. 9
- **Discover your strengths.**
- **The strength of an organization is in its people, all else are aids to the human mind.**
- **Selection is a joint employee and organizational task.**

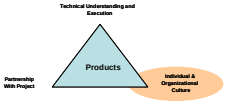


Motivation

There is a person inside me who wants to:

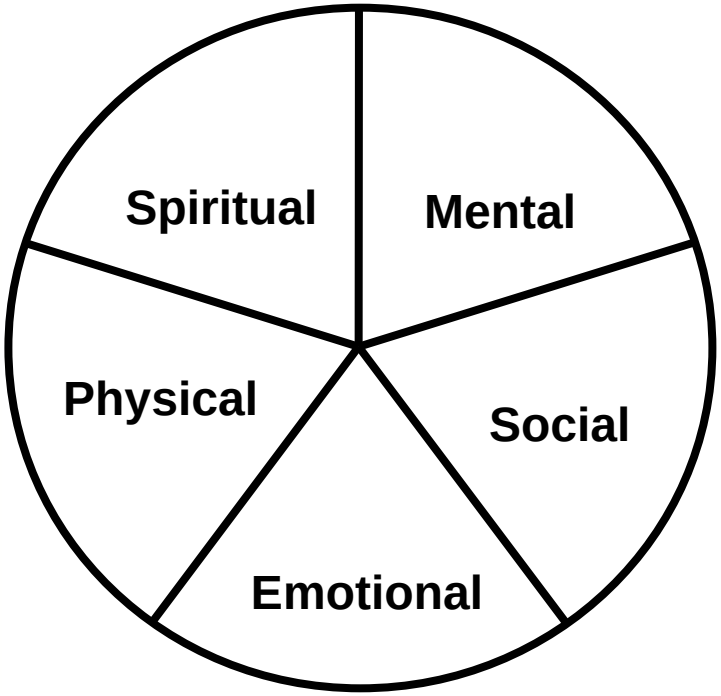
- **Design a church**
- **Run for office**
- **Learn to cook**
- **Build the Space Station**
- **Write a song**
- **Counsel youth**
- **Climb a mountain**
- **Live in Spain**

–Boeing Ad in LaunchSpace

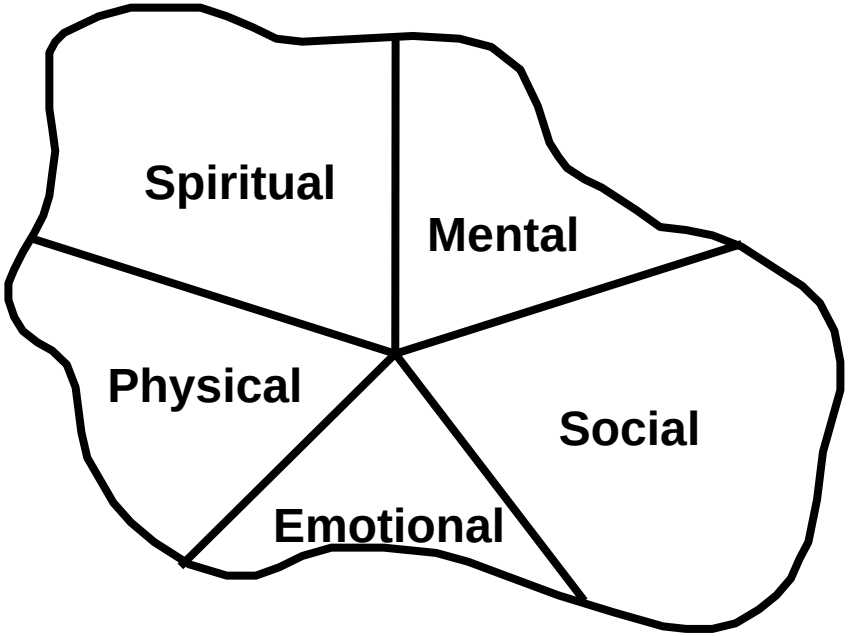


Right People in Right Places

The Wheel of Life

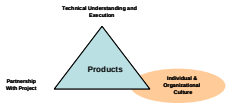


Integrated Person



Typical Person

Must understand the principle of compensation (overcompensation for weakness), balancing out the five areas of life to the degree possible, then accepting the results.



Right People in Right Places

How do I discover my gifts?
How does the mentor help me discover my gifts?

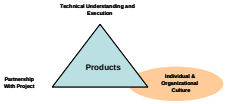
- **What are my interests?**
  - Family?
  - Professionally?
  - Socially?
  - Avocationally?

- **What do others ask me to do? Expect of me? Reinforce in me?**
  - Family?
  - Professionally?
  - Socially?
  - Avocationally?

- **What do I see that needs to be done? Your calling is what you recognize as needs.**

- **What pulls me (calling)?**

- **What do I admire in others? Who are my role models?**

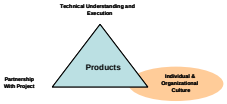


Right People in Right Places

Choice

Where You Go Depends on the Choice You Make

The Forks of the Road Choice



Individual and Organizational Culture

Right People in Right Places

FREEDOM AND POWER IN PEOPLE TO CHOOSE

Motivations

MEANING
LOVE
DUTY
REWARD
FEAR
ANGER

Creative excitement
Heartfelt commitment
Cheerful cooperation
Willing compliance
Malicious obedience
Rebel or quit

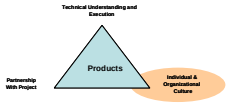
Choices

Covey, Stephen: *The 8th Habit*

Role of the Organization

- **Recognize each employee's unique gifts and capabilities**
- **Put them in the right places within the organization**
- **Foster their continued growth**

> ***" When an employee shows up for work, you've already purchased his or her…IQ points, or at least you have an option on them. At the end of each day, you have either exercised the option or you've let it expire. That day will never come again, and the option on that day's IQ points is gone forever."***
>
> **Karl Albrecht**



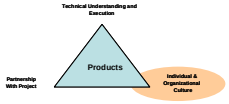
Individual and Organizational Culture

Learning Organization

"A secret for moving into the future is for the organization to become a Learning Organization."

- **Mental Models**
- **Personal Mastery**
- **Team Learning**
- **Shared Vision**
- **Systems Thinking**

Senge, Peter: *The Fifth Discipline*



Mental Models

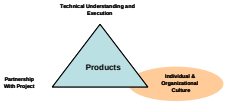
Mental models are the “pictures” we carry in our heads…the way we look at life and work…our personal framework for how we make sense out of the world, and how we take action.

Our mental models are deeply ingrained assumptions, attitudes, generalizations, pictures, or images that influence our behavior.

Very often we are not consciously aware of our personal mental models, or the effects they have on our behavior; but, in fact, we are seeing the world through our own personal lens.

The skills of Reflection, Inquiry, and Dialogue, which help us surface and evaluate our mental models, are essential to effectively analyzing and taking action on critical issues.

- Coy Brown



Mental Models

Advocacy and Inquiry

LOW ADVOCACY / HIGH INQUIRY

* Asking questions but not revealing your views

HIGH ADVOCACY / HIGH INQUIRY

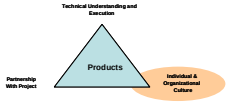
* Communicate: Conclusions, data, steps in your reasoning
* Inquire to discover steps and gaps in one another's reasoning

LOW ADVOCACY / LOW INQUIRY

* Not revealing your views or questioning other's views
* Silent withdrawal

HIGH ADVOCACY / LOW INQUIRY

*Advocating your view but not inquiring into others' views

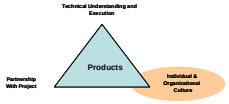


Individual and Organizational Culture

Personal Mastery

Personal Mastery is the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of learning how to see current reality more clearly. It entails a level of proficiency and involves aspiration.

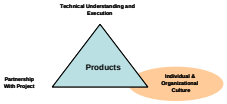
- Coy Brown



Personal Mastery

- **Organizations learn only through individuals who learn.**
- **Grounded in competence and skills but goes beyond**
- **“Means approaching life as a creative work, living life from a creative as opposed to reactive viewpoint.” —Senge**
- **“The essence of personal mastery is learning how to generate and sustain creative tension in our lives.”—Senge**
- **Personal Vision: The ability to focus on ultimate intrinsic desires, not only on secondary goals, is the cornerstone of mastery.**
- **Vision must be formed in concert with his or her purposes, a sense of why he or she is alive.**
- **The gap between current reality and the vision is the source of creative energy.**
- **Personal mastery is an integration of reason and intuition that is achieved naturally when they commit to use all resources at their disposal.**
- **It is a commitment to the whole.**
- **Personal mastery teaches us to choose.**
- **Unique, never to be repeated again. What is your uniqueness?**
- **The essence of personal mastery then is how to generate and sustain creative tension in our lives. This is anchored by personal vision, which focuses on ultimate intrinsic desires and not secondary goals.**

Senge, Peter: *The Fifth Discipline*

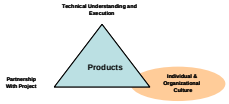


Team Learning

Team Learning… is the process of aligning and developing the capacity of a team to create the results its members truly desire.

It is a discipline that requires a commitment to continuous study of the interpersonal group dynamics and the team problem-solving tools.

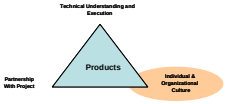
The discipline includes becoming skilled in slowing down our thinking processes and observing and analyzing the group “process”—becoming aware of ways to enhance clear communication.



Team Learning

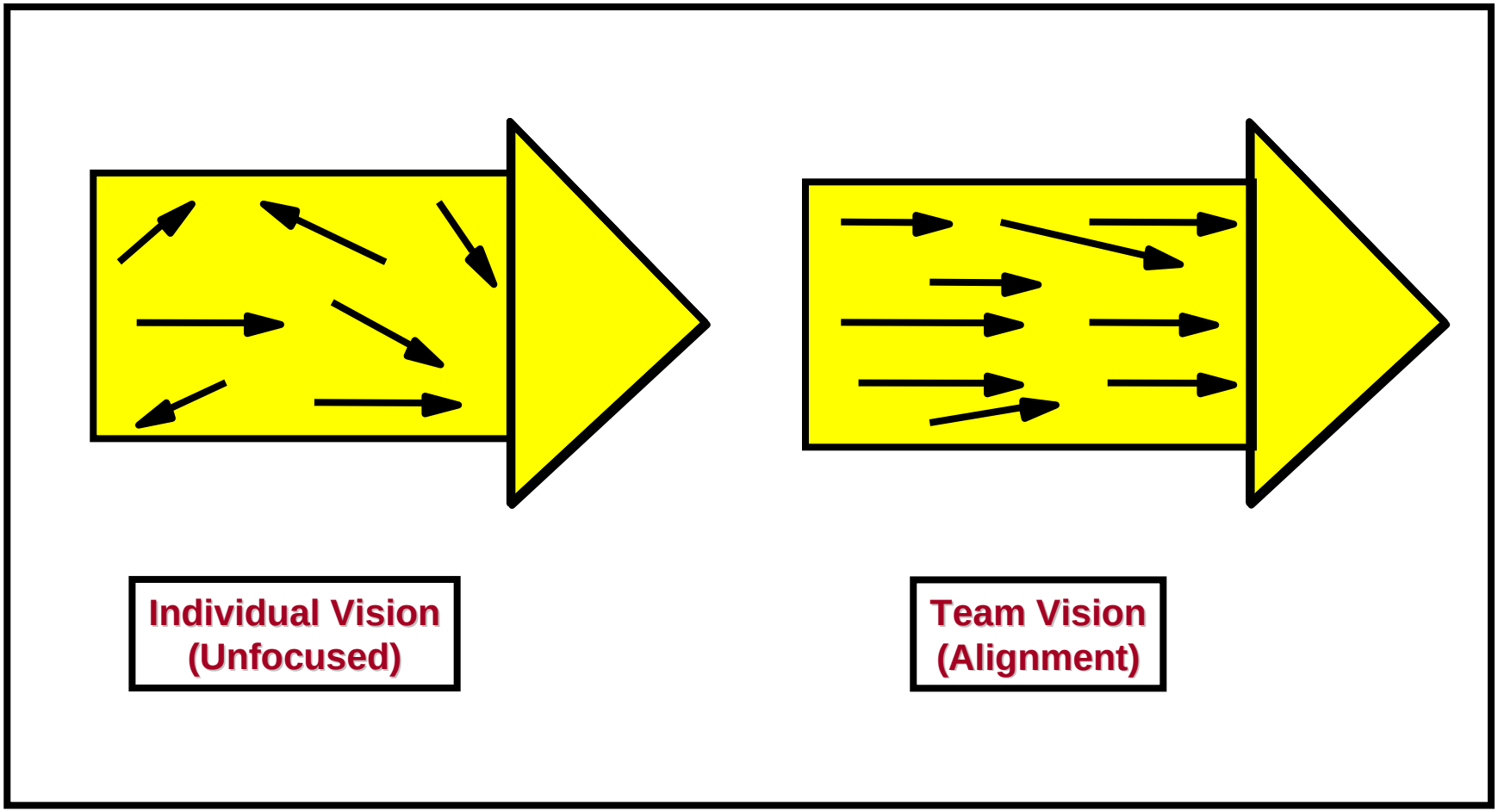
- **"Collectively, we can be more insightful, more intelligent than we can possibly be individually. The I.Q. of the team can, potentially, be much greater than the I.Q. of the individuals." -** Senge
- **Requires dialogue. In dialogue, people become observers of their own thinking.**
- **It starts with self-mastery/self-knowledge, but involves looking outward to knowledge of, and alignment with, others on your team.**
- **Suspends assumptions to honor the passion of the other person's viewpoint.**
- **It is a trusting relationship.**
- **Emphasizes diversity with unity.**

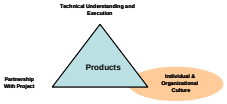
Senge, Peter: *The Fifth Discipline*



Individual and Organizational Culture

Team Learning

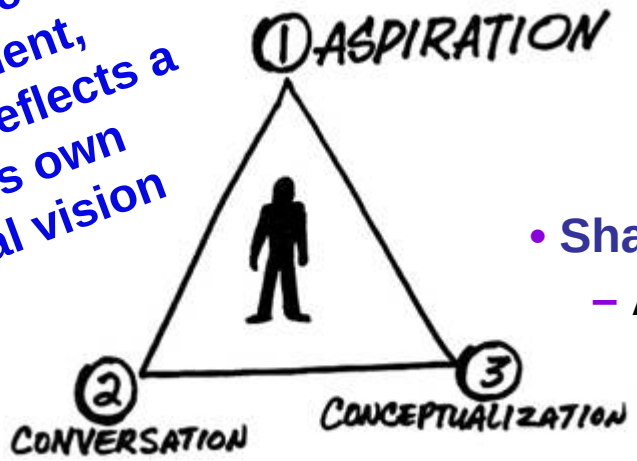




Individual and Organizational Culture

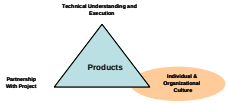
Shared Vision

It goes beyond "Compliance" to Commitment, because it reflects a person's own personal vision



- **Shared Vision**
  - **Alignment of values**
    - **Empowered people**
      - **Inspired workforce**
        - **Involved and committed leaders**

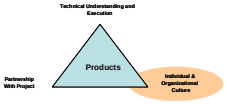
- Coy Brown



Shared Vision

- **Shared visions emerge from personal visions.**
- **The hologram is the example. When you add up the pieces, the whole (image) does not change fundamentally.**
- **Requires that you "hold" the vision while remaining committed to seeing current reality clearly.**
- **Involves**
  - **Telling**
  - **Selling**
  - **Testing**
  - **Consulting**
  - **Co-creating**
- **Must be based on the purpose of the organization. Focused around building shared meaning. Collective sense of what is important.**
- **A shared vision implies commitment.**

Senge, Peter: *The Fifth Discipline*

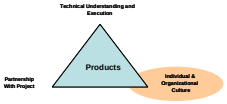


Systems Thinking

Systems Thinking:
Parts of the whole system influence all the other parts, and that influence is often/usually hidden from view.
(You gotta look for it!)

- Our vehicles and spacecraft, as well as human endeavors, are systems, bound by invisible fabrics of interrelated actions.

- Systems Thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past 50 years, to make full patterns clearer, and to help us see how to change them effectively.



Systems Thinking

- **Systems thinking requires a wide-angle lens.**
- **Pictures process: Every element a cause and effect.**
- **Systems thinking starts with the concept of feedback.**
  - **Reinforcing loop (engine of growth or instability)**
  - **Balancing loop (stabilizing and/or retarding)**
- **The nemesis to system thinking is**
  - **Compartmentalization**
  - **Fractionalization**
  - **Specialization**
- **Every organization is both collective and highly individual.**
- **Leverage in organizational life and in personal life is in the balancing loop.**

Senge, Peter: *The Fifth Discipline*

SIX PRETTY GOOD IDEAS

- Mike Rudolphi

Be Safe

Do It Now

Communicate

Leave It Better

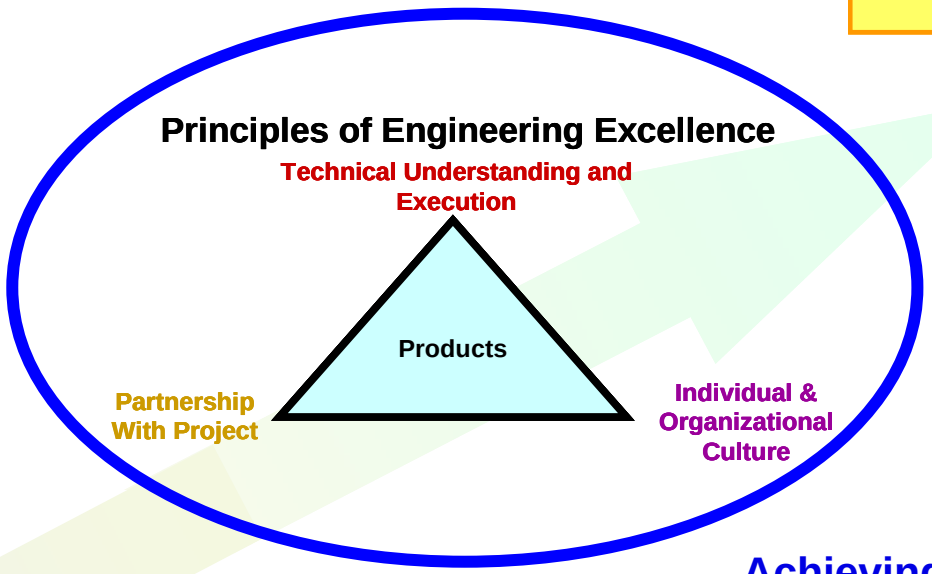
Engage

Make Yourself Better

Summary to Success

Product Success

Product, Organization & Personnel Excellence



Root Causes of NASA Failures/Problems

1. Shifting from engineering "hands on" and "excellence" to "insight/oversight". Lack of ownership
2. "Normalization of the deviances". Not questioning anomalies.
3. Lack of critical thinking. Over-reliance on procedures and computer codes.
4. Decentralization of authority.
5. Organizational and technical complexity.

Achieving Product Success Requires Integration Of All Principles Of Engineering Excellence

It's Our Time

Application of principles of engineering excellence ameliorates root causes and achieves product success

The Things That Haven’t Been Done Before

The things that haven’t been done before,
Those are the things to try;
Columbus dreamed of an unknown shore
At the rim of the far-flung sky,
And his heart was bold and his faith was strong
As he ventured in dangers new,
And he paid no heed to the jeering throng
Or fears of the doubting crew,

The many will follow the beaten track
With guideposts on the way.
They live and have lived for ages back
With chart for every day.
Someone has told them it’s safe to go
On the road he has traveled o’er,
And all that they ever strive to know
Are the things that were known before.

The Things That Haven't Been Done Before, cont'd

A few strike out, without map or chart,
Where never a man has been,
From the beaten paths they draw apart
To see what no man has seen.
There are deeds they hunger alone to do;
Through battered and bruised and sore,
They blaze the path for the many, who
Do nothing not done before.

The things that haven't been done before
Are the tasks worthwhile today;
Are you one of the flock that follows, or
Are you one that shall lead the way?
Are you one of the timid souls that quail
At jeers of a doubting crew,
Or dare you, whether you win or fail,
Strike out for a goal that's new?

Edgar Guest